

# CAPE OF GOOD HOPE.

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MINISTERIAL DEPARTMENT OF CROWN LANDS & PUBLIC WORKS.

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## R E P O R T S

BY THE

INSPECTORS OF DIAMOND MINES

IN THE LATE PROVINCE OF

GRIQUALAND WEST,

(Including that of the Assistant Inspector of Machinery),

FOR THE

YEAR 1882.

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Presented to both Houses of Parliament by command of His Excellency the Governor  
1883.

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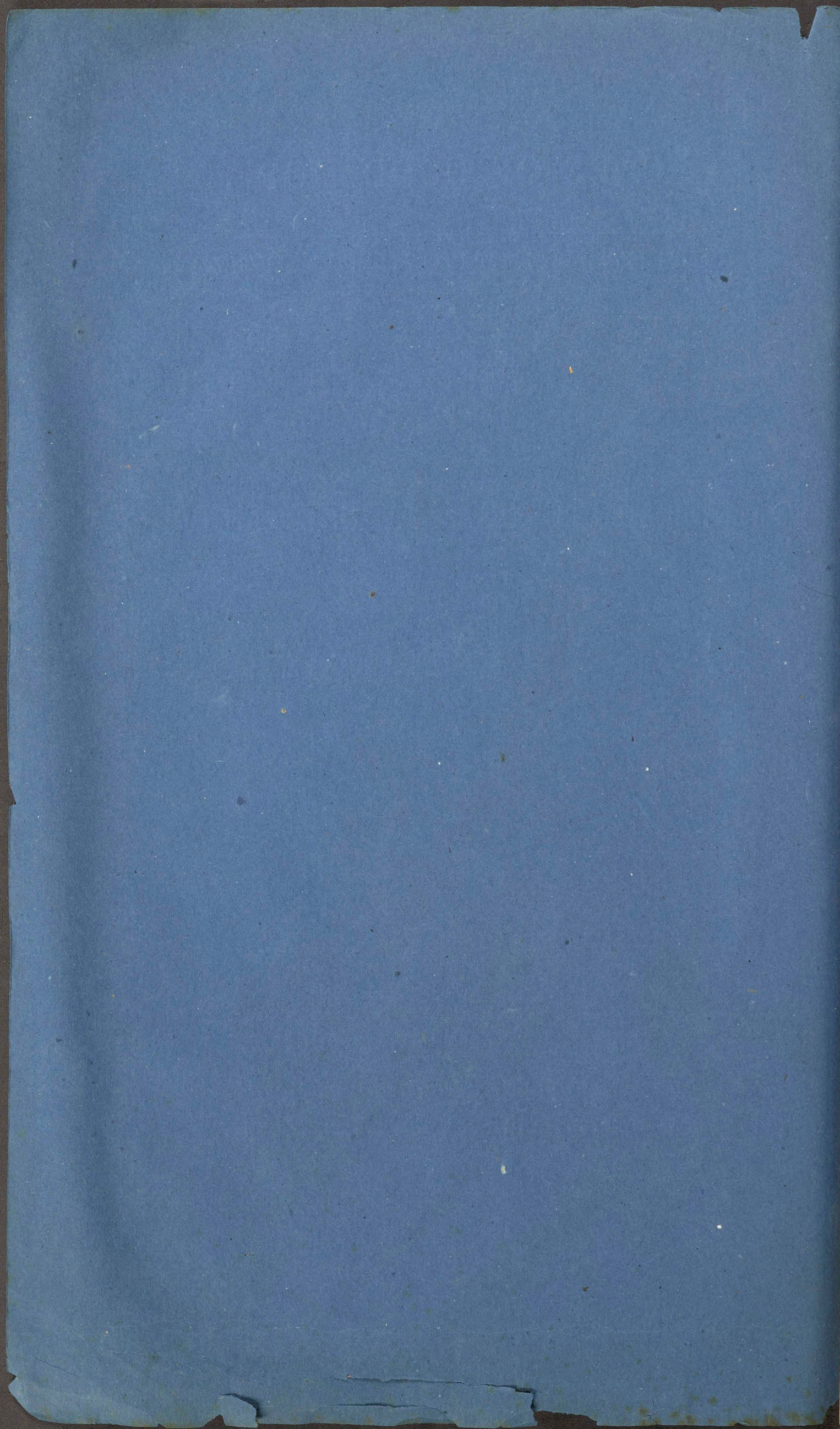
CAPE TOWN:

W. A. RICHARDS AND SONS, GOVERNMENT PRINTERS.

1883.

[G. 34—'83.]







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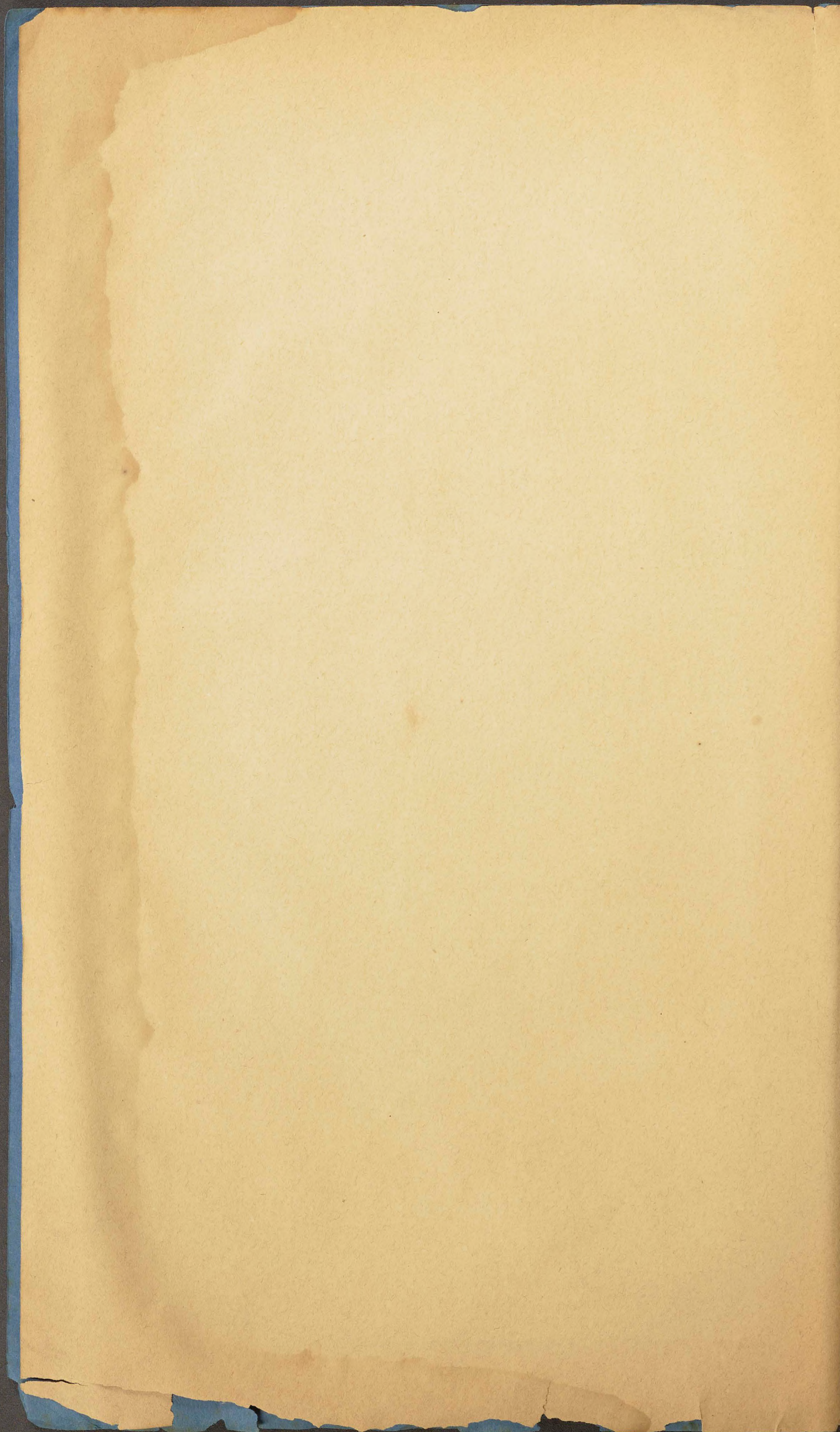
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Diagram of Claims, De Beer's Mine.

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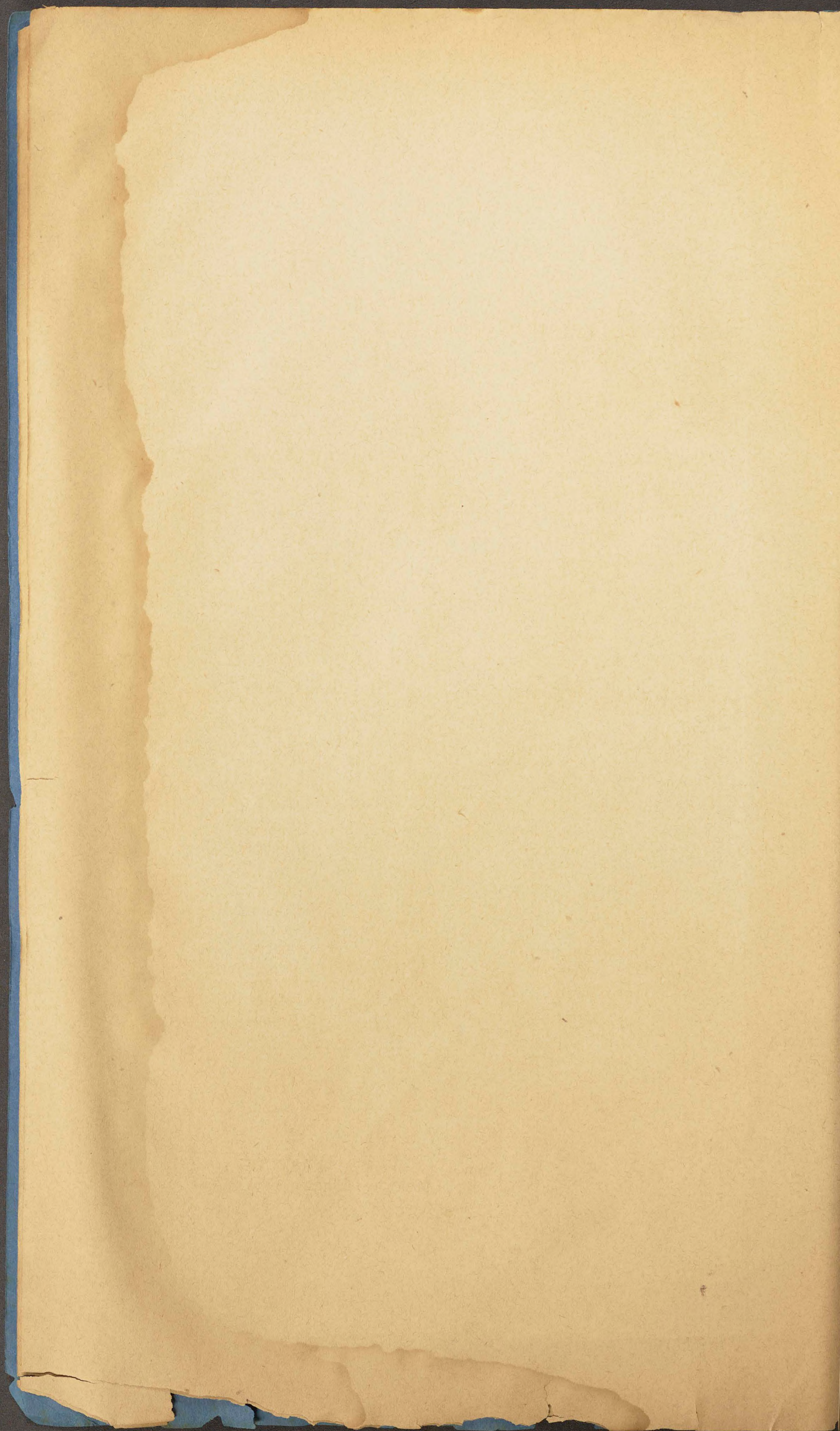
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MINISTERIAL DEPARTMENT OF CROWN LANDS & PUBLIC WORKS.

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## REPORTS of the Inspectors of Diamond Mines in the late Province of Griqualand West (including that of the Assistant Inspector of Machinery), for the Year 1882.

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Presented to both Houses of Parliament by command of His Excellency the Governor.  
1883.

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REPORTS OF THE INSPECTORS OF DIAMOND MINES IN THE  
LATE PROVINCE OF GRIQUALAND WEST (INCLUDING  
THAT OF THE ASSISTANT INSPECTOR OF MACHINERY),  
FOR THE YEAR 1882.

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COPY.—No. 41/83A.]

*The Inspector of Mines, Kimberley, to the Commissioner's Office.*

Chief Inspector of Mines Office, Kimberley,  
10th February, 1883.

The Assistant Commissioner of Crown Lands,  
Cape Town.

SIR,—Herewith I have the honour of forwarding, for the information of the Honourable the Commissioner of Crown Lands, my Report for 1882, with list of accidents, synopsis of standing orders for safety, plans of claims and various sections, as appendices thereto, on the mines and diggings under my supervision as Inspector; together with the following annexures, viz.:—

- I. Statement of Revenue collected by the Registrar of Mines during 1882.
- II. Statement of the number of Holdings in Mines and Diggings on Vooruitzicht, by the Registrar of Mines.
- III. Table of Prospecting Licences issued during 1882 by the Distributor of Stamps.

The General Report on the Machinery in use at Diamond Mines in Griqualand West, under preparation by the Inspector of Machinery, I shall forward in course of a few days.

I have, &c.,  
(Signed) W. C. C. ERSKINE,  
Inspector of Mines and Diggings on Vooruitzicht.

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## KIMBERLEY DIAMOND MINE.

1. The extreme depth of this mine has increased but little during the past year; at the lowest point—bottom of the reservoir—it is about 420 feet, which is comparatively but a slight increase in extreme depth. But the mine “over all” is very much deeper, and consequently the dangers are greatly increased to persons below, from pieces of reef or ground becoming detached and falling from the steeper sides. The working places under operations during 1882 may be taken as at an average depth, at the end of the year, of about 340 feet from the surface.

2. The main or “hard rock” has been laid bare as a nearly vertical face of over 90 feet high, and is exposed for over 200 feet laterally on the north sides of the mine. The upper edge of this rock is reached at nearly 280 feet from the surface, both on the north and south sides of the mine. The specific gravity 2.87, being just the mean between Scotch and Welsh basalts, which are respectively 2.95 and 2.75. The thickness has not yet been proved. The outer vertical surface of it appears to be cracked, breaking off in masses after exposure, but promises to stand well when the outer portion has come away; probably the intense heat during the eruptive formation of the mine, partially fractured the face of the rock where exposed to its action. On this—the north—side of the mine, it has been ascertained by means of a trial shaft, that this rock encroaches into the mine, at a ratio of about 1 in 12 vertical, to a depth of nearly 200 feet from the top of the rock, whence it falls perpendicularly for a short distance, and then recedes from the mine at the same angle. This return angle was proved to some depth, and the rock continued to uniformly retire from the mine as far as the trial shaft went. The surface of the rock where it so recedes is vitrified, and is palpably like porcelain. On the south side the main rock, though not exposed in open workings, has been faced at two points in tunnels. As seen there, it appears to drop nearly perpendicularly. On appended plan A and sketch section B, this main rock is indicated. As the claims at the west end have not been worked to any great extent during last year, the definite contour of the main rock in that direction still remains undecided. On the east the rock, I am informed, has been faced in tunnelling operations some time ago, near to the boundary between claims 51 and 81, but I have not seen it, the tunnel being now filled up.

3. A new reef shaft has been sunk near the north-east margin, through the private enterprise of a few claimholders immediately concerned. At the eastern side an incline tramway is in use also, for removal of reef. By these two methods, as here at work, about 1,500 loads of 16 cubic feet are daily raised and hauled away by locomotives to the reef tips. This joint shaft is fully 100 feet deep; the tunnels in connection comprise about 560 feet in length. It was completed and reef-removal operations were commenced with it in October last. The incline tramway dips to a face of fully 40 feet, and commenced working in the latter part of November last. Full descriptions of the machinery and gear here used will be found in the general report on diamond mining machinery in Griqualand West by the Inspector of Machinery. On the south-east of the mine the surface reef is removed by means of carts, but very slowly, to the amount of about 250 loads daily. At the west end there are two systems of incline tramways at work; one of these has been in operation during nearly the whole of 1882, the other only since beginning of June last. By these two inclines 900 to 1,000 loads are hauled daily, one runs down to 90 feet, the other to 25 feet (50 feet at present date) from the surface. The joint shaft, the three systems of tramway above mentioned, and the removal by carts, together give daily employment to 31 white men, 330 Kafirs, 30 horses and 8 mules.

The principal operations for removal of the reef are carried on by means of the shafts belonging to the French and the Central Diamond Mining Companies, and, during portions of the year, by different aerial gears.



4. A very large area of the eastern reef has subsided since the middle of September last, reducing the width of Pniel road, at that point, to about 12 or 15 feet of available roadway. The general subsidence is gradual, but a rapid settling down usually takes place in from a week to ten days after heavy rains. Great inconvenience and expense are necessarily caused to claimholders whose holdings are affected by this chronic slipping down of reef.

The reef difficulties here and at other parts of the mine are surely, and rather slowly, being overcome.

5. The reef on the south-east and the high ground and reef at the north-west, west, and south-west will constitute factors of difficulty and expense in mining operations in this mine for some time to come. The current year (1883), however, will in all probability see the reef difficulties of Kimberley mine almost if not entirely mastered, provided that the operations for removal of the reef are prosecuted without cessation and with at least as much energy as at present observable. The high ground and reef at the west end will take some time longer to work down sufficiently, and is more likely to slip before that can be accomplished.

6. As will be seen from the reef removal tables, there has been an immense quantity of reef taken out during 1882. During 1881, the quantity was given as 1,665,258 loads; while nearly 3,000,000 loads are returned as having been removed during 1882. The total amount of reef removed from this mine since it was opened in July, 1871, has been kindly estimated for me by the Chairman of the Kimberley Mining Board and others. There is but slight difference in results of the several calculations, the mean being 3,550,000 cubic yards of solid reef, the number of loads given being 9,721,612 of 16 cubic feet each. 16 cubic feet per load are equal to nearly 10 cubic feet solid.

There was considerable, and I think inexcusable dilatoriness to be overcome before operations for removal of the reef at the east, and the high ground and reef at the west end were properly taken in hand. The eastern reef was persistently stated to be sound and safe until it began to fall during the month of September last.

The reef and unpayable high ground difficulties once over, and the main rock standing as well as may be expected, there is little or no doubt that the best days of Kimberley mine are yet to come.

7. The present system of aerial tramways must soon be discarded in favour of shafts outside of, and tunnels into, the mine; though it is quite possible that advantage may be taken of the nearly perpendicular face of the main rock to construct vertical lifting gear at the edge of the rock, so as to avoid the apprehended great cost of sinking through it.

It is daily becoming more evident that this mine, especially, can never be worked to the best advantage until all the payable holdings have been amalgamated and the whole mine worked as a single holding.

8. The number of claims in which diamondiferous ground has been worked during last year, or during periods thereof, cannot be much over 150, certainly under 200. But of these, very few comparatively have been worked regularly or without interruption during the year.

9. The diamondiferous ground in some portions of this mine, is said to be worth nearly £5 per load of 16 cubic feet, but the general average of the mine for last year may be taken, for the ground worked during that period, at about 38s. per load. The great fall in the price of diamonds during the last quarter of 1882 has caused, however, a reduction in value for the present of about 30 per cent.

According to the rating of the last assessment of the value of diamondiferous ground in *all* the holdings in Kimberley mine, the average value for the whole mine per load is about 24s. But the average value of ground in holdings worked during the whole year and the latter period of the year, would, under the assessment valuations be, about 40s. per load.



## STATISTICS.

10. The "blue" ground of Kimberley mine yields on an average per load of 16 cubic feet,  $1\frac{1}{2}$  carats.

No "yellow" ground is worked.

11. One gear working all year round in the "blue," allowing for delays from fallen reef and other causes, may be put at delivering a total of 50,000 loads in the twelve months.

The equivalent of approximately twenty gears worked regularly in "blue" during the whole of 1882, giving a result on above estimate of 1,000,000 loads delivered. As, however, many of the tubs used measure in capacity considerably over 16 cubic feet, the total quantity of ground hauled may be more nearly reckoned at 1,100,000 loads of 16 cubic feet.

12. 1,100,000 loads at  $1\frac{1}{2}$  carats yield 1,320,000 carats. Taking 30s. as the average price per carat obtained during last year, we have £1,980,000 as the value, based on the carats per load, of the blue ground hauled during 1882. By my estimated average money-value per load (38s.) of the ground in claims worked during the last year (see paragraph 9) the value of 1,100,000 loads would be £2,040,000, and according to my calculation (40s. per load), based on the last assessment valuations of holdings (see paragraph 9), the value of 1,100,000 loads would be £2,200,000.

13. The quantity of diamonds won by washing and picking, I should estimate roundly from 700,000 loads worked, at 840,000 carats, of the aggregate value of £1,260,000 as the result legitimately realized of diamond mining operations in this mine for last year.

14. By my estimate arrived at from the working of the mine (see paragraph 13), the realized quantity of diamonds and value are computed at 840,000 carats of £1,260,000 in value, adding to which the moderate estimate of 25 per cent. as having been absorbed by the I.D.Bs., we obtain a grand total of 1,050,000 carats, worth £1,575,000, as the approximate total value of diamonds realized during 1882 from Kimberley mine.

Working expenses to win, appear to run from 12s. to 20s. per load washed.

15. The quantity of reef solid and fallen, and débris removed from the mine during last year, is returned by the Mining Board as 2,971,272 loads of 16 cubic feet, at a cost to the Board of £528,171 8s. 4d.

The tariff paid for removing solid reef was 2s. 9d., débris 1s. 6d., and fallen reef from claims 3s. 9d. per load of 16 cubic feet.

16. The average daily quantity of water raised was 33,000 gallons, at a cost of 6d. per 100 gallons.

17. The number of employés daily at work in and about the mine on an average were: White men 300, Kafirs 1,900, and on tramways and floors,

White men 420, Kafirs 2,100

720

4,000

Giving a total of over seven hundred white men and four thousand Kafirs as having been employed daily in mining operations at Kimberley mine and floors.

Wages averaged: Engine-drivers and Artificers £7 10s., Overseers £5 per week without food or lodging, and Kafirs £1 10s. per week with lodging, wood, and water, but no food.

About 420 horses, 100 mules, and 120 oxen were daily at work. The cost of feeding horses and mules averaged from £1 10s. to £2 per week.

18. The cost of firewood and coals used at the mine and floors I estimate at £170,000 for 1882. The average price of firewood per load was £15, and of coal per ton £12. Firewood has been found to be the cheaper fuel. The coal used was principally obtained from Free State mines, and is of inferior quality as compared with English coal. The average expense for fuel per load of ground hauled and washed may be put at 10d.



19. About 12 miles of tramway of 18 inch gauge as a single line, have been laid down up to the end of last year, and some  $1\frac{3}{4}$  miles of locomotive railway of 3' 6" gauge.

A full description of the machinery, &c., in use will be found in the Inspector of Machinery's Report.

#### DE BEER'S MINE.

20. At the lowest working place is fully 260 feet deep. The active operations in diamondiferous ground during the greater part of 1882 have been nearly all in payable "Blue," and as a consequence the average value per load of diamondiferous ground hauled is much higher than as shown in my Report for 1881.

21. In this Mine there is a very large mass of floating reef which necessarily cuts out diamondiferous ground to some extent in many claims, and in some cases to a considerable depth. It forms a most discouraging incubus to mining operations, but is gradually being removed. Below this floating reef it has been found, from ordinary operations by some miners and shaft sinking by others, that the diamondiferous soil continues, therefore the floating reef, though an expensive obstacle, appears to be not an insurmountable one.

22. Through the diamondiferous ground run a number of dykes, averaging 4 feet thick towards the east end of the mine, and tapering off to a few inches as they extend into the claim ground toward the west and south. The ground close up to these dykes at the north-east has been found peculiarly rich, 5,000 loads yielding £5,000 in value. But some of the "blue ground" in this Mine is held to be worth over £2 per load. The specific gravity of the dyke rock is 2.66.

23. The western portion of De Beer's Mine is but little worked, the claims there being still in the "yellow," which would doubtless have been regularly worked had water been obtainable at a reasonable price for washing purposes, as the yellow ground does not require to be exposed to atmospheric action, as is necessary in the case of "blue," but goes from the claims direct to the washing machine. The yellow ground about the south-west, where exposed by working, looks as if it should yield well.

On the south side some blocks of claims are worked with satisfactory results, but the floating reef here cuts out a considerable area of diamondiferous ground to, it is believed, an inconvenient depth. Yet where the ground underneath this floating reef has been excavated, the yield in diamonds is, I am told, very good.

Round by the south-east and east the "blue" has been worked lately in a number of claims.

On the north-east, and partly on the north, the blue ground has been excavated during the whole of 1882. The workings here are the deepest in the mine, and occupy a belt of approximately six or seven claims in width, alongside the standing reef, and the yield in diamonds of the ground here is excellent. It is also stated to become richer as the workings deepen.

The average depth from the surface, at the red soil of claim ground under mining operations, may be put at about 190 feet at the end of 1882.

24. Contrasting with the Kimberley Mine, the reef enclosing the De Beer's Mine stands remarkably well. Operations for gradual removal of the top weight by a system of terraces, are carried on regularly, though too tardily, I consider, to keep pace with the excavation of diamondiferous ground.

The surrounding reef removed from this mine since the end of 1877 up to the end of 1882, is returned by the Mining Board at about 215,000 cubic yards in the solid. From lack of data the total quantity of reef taken out since the mine was opened could not be supplied to me.\*

\* NOTE.—The quantity, 407,482 loads of reef, given in my report for 1881 as having been hauled during that year was the total quantity removed out of the mine up to the end of 1881.



Amalgamation in this, and in all Diamond Mines, appears to me a consummation earnestly to be desired. With a syndicate to regulate the general production I cannot imagine a more profitable industry than Diamond Mining.

The appended plan and sketch section of the mine and vertical section of strata exposed in sinking the Victoria Diamond Mining Company's shaft, marked D, E, and G respectively, may render my description of the mine more easily understood.

#### STATISTICS.

25. The quantity of solid main reef removed during the last years is given as follows:—

During 1878	...	...	...	20,150 cubic yards.
„ 1879	...	...	...	20,380 „ „
„ 1880	...	...	...	43,200 „ „
„ 1881	...	...	...	51,800 „ „
„ 1882	...	...	...	79,800 „ „
				<hr/> 215,330

costing nearly £76,000.

26. Each load of 16 cubic feet of “blue” ground is computed to yield on an average one carat of diamonds, and of “yellow” ground one-eighth of a carat.

One gear working all the year round in “blue” ground, allowing for delays on account of falls of reef and other causes, delivers approximately 75,000 loads during the twelve months, and working similarly in “yellow” about 100,000 loads.

The equivalent of about eleven gears worked regularly during 1882 in “blue” ground, hauling on the above estimate for the year 825,000 loads, and similarly six gears worked in “yellow” delivering for the twelve months 600,000 loads, giving an approximate aggregate of 1,425,000 loads of diamondiferous ground hauled during last year.

27. Taking the loads at an average of 16 cubic feet each, we have, according to the above estimated value, 825,000 loads of blue ground, portion of which, however, was very inferior, yielding

810,000 carats, and 600,000 loads yielding  
75,000 carats.

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885,000 carats.

For 1882 the average price per carat may be put at 30s. for diamonds from De Beer's Mine, and £1,327,500 will therefore represent the value of the diamondiferous ground excavated and hauled during 1882.

28. The amount of diamonds won by washing and picking may be computed at 595,000 carats from blue and 13,500 carats from yellow ground, giving a total of 608,500 carats, of the value of £912,750 as the realized value from operations during 1882.

The above estimate of diamonds won may be very wide of the mark; only a few Companies complied with my request for an accurate return of the year's work done, and therefore I have had insufficient data to work upon.

29. Add to this, 25 per cent. as the fruits for last year of illicit traffic, and we have a total of 760,625 carats of £1,140,937 10s. in value, as having been won from De Beer's Mine during 1882.

30. Operations in diamondiferous ground were carried on more or less regularly in about 250 claims, as nearly as I could say from personal observation, and for removal of floating reef and non-payable ground from nearly 50 claims.



31. The tariff paid by the Board for removal of solid main reef was 2s. 11d. per load, and for hauling fallen main reef from claims 2s. 6d. per load. Floating reef, being in the claim ground, has to be removed at the expense of the claimholder in whose ground it may be found.

32. About 35,000 gallons of water per diem were raised daily from this mine, the cost being £900 per month; the pumping contractor using the water for ground washing. The Board gives £10,800 as total cost of removing water from the mine during 1882.

33. The number of employes daily at work in and about the mine, on an average, were: ... White men 170 ... Kafirs 1,000  
On tramways and floors ... „ 100 ... „ 700

270	1,700
-----	-------

Nearly 300 white men, variously occupied, and about 2,000 Kafirs daily employed in mining operations at De Beer's mine and floors.

Wages run from £4 12s. 6d. to £8 per week to white men, without food or lodging, and average 25s. per week to Kafirs, with lodging.

About 250 horses and mules were daily at work.

34. There have been laid down nearly 12 miles of tramway, calculated as a single line.

35. The cost for 1882 of fuel used at the mine and floors must have been nearly £70,000.

A full description of the machinery, &c., in use, will be found in the Report by the Inspector of Machinery.

#### ST. AUGUSTINE'S MINE.

This remains in *statu quo*.

#### OTTO'S MINE.

Was worked to a very small extent, owing, I believe, to want of funds.

A few thousand loads of the yellow (surface) ground were washed.

The blue ground here has not been thoroughly tested. All work at present is suspended.

#### TAYLOR'S KOPJE

Has been abandoned, and again taken up; but nothing in the way of mining operations are going on.

#### GENERAL REPORT.

*Accidents*—detailed list of accidents appended and marked I.

36. During 1882 there have been in the Kimberley and De Beer's Mines, together, 31 accidents which may be termed preventible, that is to say, of which the causes are attributable to defective gear, unnoticed damage to gear, or on account of culpable carelessness in the use of appliances, &c.; of these, 20 have occurred in connection with machinery or gear, 9 having been attended with fatal results. The remainder of preventible accidents being caused by explosion of blasting agents, &c., or otherwise than on account of machinery or mechanical appliances.

[G. 34—'83.]



There were 25 preventible accidents during 1881 for both Mines, of which 16 were in connection with gear or machinery, 12 being attended with fatal results; but, the register for 1881 not giving detail in all cases, the number may be understated.

From an old register of casualties for 1880, commencing 5th February, there were 50 accidents during that year, from which 69 persons suffered. Of these accidents 17 appear as having occurred from preventible causes.

37. The great majority of non-preventible accidents have been caused by falls of reef or ground, or by pieces of reef or ground becoming detached and falling from the sides of the mine.

38. Very great risks attend riding in tubs and cages running on standing wires of aerial gears, and such practices are therefore very dangerous. In the case, however, of white men and "Cape boys" riding in tubs to and from work in the open mine, the privilege cannot be advantageously refused, as on account of the exertion required, especially in Kimberley Mine, in walking or rather scrambling down and up the steep sides of the mines, overseers refuse to work unless allowed to ride in tubs and cages. Managers and others on duty necessarily descend and ascend by the aerial gear. And such men can so make use of aerial gear without running too great danger, as caution, presence of mind, and common sense tend to prevent incurrence of avoidable risk.

But with the ordinary raw Kafir the case is quite different, and formerly, when Kafirs were allowed to ride in tubs, accidents happened frequently.

During 1881 eight Kafirs suffered from accidents through riding in tubs, and I prohibited Kafir employés so making use of aerial gear. Last year no accidents occurred to Kafirs from this cause, as far as I am aware, though there have been frequent instances of their riding in tubs against orders.

39. Nor is it necessary at present that the ordinary Kafir labourer should proceed to or leave his work by other means than walking. 15 minutes usually permits of all labourers getting clear of either Kimberley or De Beer's Mines, and provided that practicable pathways with good foothold be maintained, and short strong ladders securely fixed where requisite, there is nothing to prevent Kafir labourers and any other persons getting to their work in the mine and leaving the same in safety and with sufficient facility, for some time to come.

The only obstacle to maintaining suitable pathways is the frequent modification or alteration of route rendered necessary from mining operations, and, notably in Kimberley Mine, on account of the subsidence of the surrounding reef. There is, however, very little real difficulty in accommodating the pathways to the changes in the claim ground and reef, so as to afford at all times safe and easily practicable means of access and exit to and from working places in the mine.

Expense is the only obstacle worth consideration, but once the pathways were constructed and necessary accessories—such as ladders and hand lines—provided, the expense of maintenance and deviations would not exceed, I think, the equivalent of one white labourer employed regularly to look after these means of entrance and escape in each mine, and such an expenditure could scarcely be deemed extravagant or unwarrantable, considering that thereby the hundreds of labourers in these mines would be at all times provided with satisfactorily safe means of getting to and from their work. I have endeavoured, as far as my powers allow, to have such practicable pathways constructed and maintained in safe condition. In the De Beer's Mine good pathways have been constructed and ladders fixed where necessary at vertical places.

40. Seven persons suffered, of whom two died, from accidents in Kimberley Mine last year, owing, I consider, directly or indirectly, to the lack of properly-made and safely-kept pathways, as, had there been a sufficiency of such safe means of easily entering and leaving the mine, there



would have been no inducement to labourers to use casual and risky tracks, thereby not only running risk themselves, but, through displacing loose reef or stones, endangering other persons in lower places, though it would be impossible by any provisions for safety to absolutely prevent Kafirs running their generally stupid heads into danger.

In De Beer's Mine a bad accident occurred (see 30th October in De Beer's List of Accidents) by which two Kafirs were killed while going up one of the regular ladders, but the Board was in no way to blame for inattention to that pathway; the lumps of reef causing the deaths and damage were displaced inadvertently—it is supposed—by a Kafir on high ground hauling on a slack wire lying among some fallen reef on the higher claims. The Kafir bolted immediately, and could not be identified.

41. Ladders, as a means of adding to convenience for entering and leaving the mine, if carried to excess in length, and so admitting of too many persons collecting on them, or from their height causing a fall from off them to be fatal, may be sources of danger instead of means of safety. They would also be actually dangerous if not perfectly strong and thoroughly well secured.

42. Owing to the great increase of the general depth, pathways and ladders must be by and bye discarded, at all events partially, as impracticable methods, in favour of some mechanical means of entering and leaving the Kimberley Mine; but such mechanical means must be specially designed for carrying persons, as the present aerial gear as now in use is, I consider, quite unsuitable for rapid and easy transit, with safety, of the ordinary stamp of labourers presently employed in the Diamond Mines.

43. There have been a few convictions for contravention of Orders for Safety during 1882, and some of my cases were lost through errors in the summonses and technicalities, but on the whole I have had very little difficulty with claimholders in either mine. It is but natural that there should be instances of evasion of Orders for Safety, as the nature of my duties and orders necessarily means interference to some extent, in most instances.

44. Taking into account the great depth of Kimberley Mine, about 400 feet, the treacherous character of diamondiferous ground, the instability of the surrounding reef, the steepness of the sides, and the number of persons daily employed in this mine—over 2,000 on a regular average—and the present style of working and system of aerial gear, I submit that we can only feel surprised, not that accidents are numerous, but that they are so few. Especially is this true as regards the aerial gear, which but for the care generally observed and the usual excellence of material and workmanship—rough certainly—would be a chronic source of disaster.

#### MAGAZINES.

45. The Magazines for storage of explosives are situated as a group on an extreme portion of De Beer's Mining area, distant about a mile from De Beer's Mine; there are a few dwelling houses at less distance. These Magazines, about 15 in number, are simply small houses, of an average size of 16 × 20 feet in width and length, constructed of wooden framing covered with sheets of corrugated iron.

In each are stored quantities of dynamite and other explosives up to 1,500 cases, each case containing 50 to 60 pounds weight. Detonators, fuses, and gunpowder seem to be kept in the same magazines with dynamite in perfect confidence. Some of the magazines are not even brick-lined, and facilities for theft or malicious mischief could not easily be more readily afforded.

There is no enclosing wall round these buildings, nor any watch either by day or night to look to their safety. They are built simply on the open



veld and are unguarded in any manner. Nothing at present could prevent, as far I can see, an evilly-disposed person from purloining any quantity of dynamite or other explosive from some of the magazines, with perfect impunity.

By removing a sheet of iron from the wall, easily done with a screw-driver, entry could be effected and theft or other damage committed; and, if during the night, without the remotest risk of detection or identification.

Lately, in one instance, it had been found that Kafirs or other persons had been lighting fires and cooking within one of these magazines, one-half of which partitioned off with boarding, contained gunpowder and combustibles. Shortly afterwards I saw another magazine—not brick-lined—of which one of the wall-sheets of iron was attached to the framework by only two screw nails, the aperture resulting by pulling the iron outwards, leaving sufficient space to allow of cases being abstracted from within.

Since then a third instance of risk occurred in a door of one of these magazines having been left open, and was so discovered by a passer-by in the morning.

In December last, three men were convicted of stealing a case of dynamite from the iron storehouse of a Diamond Mining Company at Dutoitspan.

46. It is to be hoped that a proper system of safe guarding such dangerous stores may be arrived at by the Committee now considering the subject. The expense of safe-guarding magazines containing explosives need not be great. For safe-guarding one central compound large enough to enclose a sufficient number of magazines to satisfy the requirements of Mining Companies in both mines and of importers in Kimberley and De Beer's, including interest on cost of building a suitable surrounding wall of corrugated iron; I estimate the expenditure as likely to be under one thousand pounds per annum, which, divided among the three interests benefited, would not amount to an extravagant yearly burden. Companies and importers building their own magazines on an approved design within the compound enclosure.

The sum of £1,000 is thus made up:—

One officer in charge, who would have sole control and act as general storekeeper, at a salary of say	...	...	£400
Two constables on duty all night relieved, at such hours as deemed necessary, at a charge each of £190	...	...	380
Interest and incidental expenses	...	...	220
Total	...	...	£1,000

During times of peace, safe-guarding as above by two constables on duty together during the night and on Sundays and holidays, would be sufficient, the officer in charge being on the spot daily during working hours, relieving the watch in the morning and being relieved by them in the evening. But as these magazines must necessarily, for the safety of the community, be at some distance from the town, and the sentries therefore far from their guard, it would probably be deemed advisable in the event of war or disturbance, to have a regular guard of at least one non-commissioned officer and six men, detailed daily for 24 hours duty at the magazines, so as to have two sentries constantly on duty. Under such circumstances I presume that the temporary extra charges would not come on the owners of Magazines.

#### THE DIAMOND TRADE ACT.

47. The Diamond Trade Act has been in operation since 1st September last, and the effect I am credibly informed has been salutary. A perceptible decrease in illicit diamond traffic is generally recognized, and I am told that the I.D.B. population is very considerably reduced.



There have been 104 cases tried by the Special Court here from 1st September to 31st December, 1882. Of these 80 resulted in final convictions; 7 have been withdrawn and 17 found not guilty. Two appeals to the Supreme Court were upheld.

#### SEARCHING RULES.

48. These are to take effect on the 1st March next, and, if practicable, without causing obstructive irritation, or entailing too great expense and delay, and provided they be adopted at all mines, will doubtless tend very effectually to the suppression of diamond thieving. Searching will be a drastic measure if honestly carried out, but otherwise may afford only an additional and safer method of thieving.

I confess that I should have more confidence in the effect of separating Diamond Mining labourers from the town and outside influences and temptations. Very few diamonds, comparatively, would be stolen were the ready markets got rid of; and it may be broadly affirmed that every Kafir canteen and every Kafir store is open to suspicion as such.

49. Could those Kafir canteens and stores in the proximity of Depositing Floors be wholly cleared off, and all, whether within the mining areas or in the townships, be subjected to rigorous supervision, I believe that searching would be almost unnecessary, especially if companies would themselves clothe and feed their own Kafirs.

Clothing, feeding, and liquors in moderation, could all be provided on a sutler system, under the complete control of the Mining Companies.

50. The overseers, a most reliable and admirable body of men, might be provided with comfortable quarters in Companies' barracks; and, with a regular overseers' mess, presided over by a foreman or senior overseer, they would of necessity be removed from many temptations and be enabled to live not only more cheaply but more comfortably than they can at present.

An *esprit de corps* would involuntarily grow up among them, than which sentiment nothing can more beneficially influence the conduct of individual members of any society.

#### HEALTH OF THE OCCUPATION.

51. The health of those engaged in diamond mining operations is not affected, as far as my observations teach me, by working constantly in diamondiferous soil, the supposed exhalations from which have been held by some as the cause of our "camp fever." The fact that managers and overseers who are continually on or working in diamondiferous ground, form the exceptionally healthy portion of the community, is evidence sufficient, I think, to exonerate the "blue" and "yellow" from the charge of being the cause of the Diamond Field fever.

The typical overseer is of necessity a sober, temperately-living member of the community; and rather to the reverse of so living may the fatality of the fever be credited than to mining operations. Those who mostly suffer from camp fever belong generally to the classes, members of which, as a rule, see diamondiferous ground only from a distance.

Drunkards occupy the first place as likely victims to this sickness, and I understand that total abstainers even are distinguished by a greater aptitude to succumb to it than those who use but abuse not, alcoholic beverages.

#### EXPORT OF DIAMONDS.

52. The three Banks in Kimberley give me returns of diamonds shipped by them during the last four months of 1882, amounting to 603,569 $\frac{1}{4}$  carats.

Through the Kimberley Post-office, 1,666 lb. weight of diamonds, including packages, were transmitted during 1882, but I have not been able to learn what amount went through the Dutoitspan Post-office for some period.



30 per cent. as tare is usually allowed off the weight of these packages sent per post. 2,240 carats go to the pound weight, so that the total weight in diamonds, transmitted through the Kimberley Post-office during last year, appears to have been 2,602,880 carats. It is, however, impossible to say from which mines—Griqualand West or Free State, or both—these diamonds came.

For 1881 the amount of carats sent through Kimberley Post-office was about 2,331,840, showing an increase for last year, as shipped through this Post-office, of 271,040 carats.

I am greatly indebted to many Mining Companies, to the Mining Boards, and to gentlemen engaged in or connected with the Diamond Mining Industry, for greater part of the data from which I have compiled this Report.

At the Kimberley Mine pathways have lately been constructed, and ladders are now being placed.

As appendices to my Report I forward the following, viz.:—

Plan of claims in Kimberley Mine marked	A.
2 sketch sections of       "       "       "	B. and C.
Section of French Company's shaft at do.	F.
Plan of Claims in De Beer's Mine       "	D.
Sketch Section of       do.       "	E.
Section of Victoria Co.'s shaft in do.       "	G.

A detailed list of accidents in Kimberley and De Beer's Mines during 1882 ;

And, Synopsis of Standing General Orders for Safety issued during 1882.

(Signed) W. C. C. ERSKINE,

Inspector of Mines and Diggings on "Vooruitzigt."

Kimberley, 6th February, 1883.

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#### SYNOPSIS OF STANDING GENERAL ORDERS PUBLISHED IN THE INTERESTS OF SAFETY OF LIFE AND LIMB, FOR KIMBERLEY AND DE BEER'S MINES.

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No. 12 of 1881 (General Order), dated 31st October, 1881.—For protection of wells situated within mining areas, by fencing or filling up.

No. 1 of 1882, dated 2nd January.—For fencing working-stages or places in certain situations to prevent material or stones, &c., falling on persons in lower places, which frequently happened.

No. 2, dated 3rd January.—For affixing safety chains or wires to tubs and cages, to provide against accident in the event of fracture of the ordinary bridle chain or its connections, which was and is occasionally occurring.

No. 3, dated 13th January.—A system of signals from claims to the drivers of hauling engines.

No. 4, dated 31st January.—Directing that copies of all orders be supplied to overseers and other servants responsible for carrying out provisions of the same.

No. 5, dated 7th February.—Regulating blasting operations in De Beer's Mine.



- No. 6, dated 28th June.—Directing how small daily supplies of dynamite may be stored close to the mine. *Note*, this order is in abeyance pending the result of deliberations of the committee on explosives, but as it fulfills the provisions of the English Explosives Act 1875, it will, if necessary, be enforced.
- No. 7, dated 1st August.—Requiring overseers to be placed in charge at tip stages in mine, to look after safe working condition of tub gear at those places.
- No. 8 issued in November, 1881, and re-issued as a standing order 10th August, 1882, prohibiting Kafirs riding in aerial gear.
- No. 9, dated 13th September.—Regulating number of persons riding in cages of shafts and directing safety appliances to be affixed to cages.
- No. 10, dated 17th November.—Prohibiting labourers entering or leaving the mine by any common pathway or route other than those pointed out by the Mining Board for their use.
- No. 11, dated 5th December.—Relates to :
1. Reporting danger to managers and employers by any employé on apprehending the same, and immediate attention thereto by the manager or employer.
  2. Reporting accidents.
  3. Reporting damage to machinery or gear to the Inspector of Machinery.
- No. 12, dated 27th December.—Directing that the rule of running trial trips to test safe state of gear after any disuse thereof, be strictly carried out.



## SUMMARY OF ACCIDENTS IN THE KIMBERLEY MINE.

1882.	NATURE OF INJURY.						RESULT.				TOTAL.	
	Blasting.		Fall of ground.		Other.		Died.		Recovered.			
	W.	N.	W.	N.	W.	N.	W.	N.	W.	N.	W.	N.
January ...	...	...	3	...	...	1	2	1	1	...	3	1
February ...	...	...	...	2	...	1	...	1	...	2	...	3
March ...	...	...	...	4	...	...	...	2	...	2	...	4
April ...	...	...	...	...	...	2	...	...	...	2	...	2
May ...	...	1	1	...	4	2	3	1	6	2	2	8
June ...	...	...	...	1	...	5	3	6	2	...	1	6
July ...	...	...	...	1	3	1	3	1	4	1	2	6
August ...	...	...	...	3	2	1	1	2	1	2	2	4
September ...	...	...	...	4	1	2	3	1	3	5	1	4
October ...	...	...	...	2	7	...	2	1	2	1	7	9
November ...	...	...	7	6	6	...	1	3	1	3	13	14
December ...	...	...	2	...	1	6	1	1	2	5	2	4
Total ...	1	10	17	31	18	21	17	26	19	36	36	62

## SUMMARY OF ACCIDENTS IN DE BEER'S MINE.

1882.	NATURE OF INJURY.						RESULT.				TOTAL.	
	Blasting.		Fall of ground.		Other.		Died.		Recovered.			
	W.	N.	W.	N.	W.	N.	W.	N.	W.	N.	W.	N.
January ...	...	...	...	1	...	...	...	1	...	...	...	1
February ...	...	...	...	1	...	...	...	1	...	...	...	1
March ...	...	...	...	...	...	2	...	1	...	1	...	2
April ...	...	...	1	4	...	...	...	1	1	3	1	4
May ...	...	...	...	...	...	...	...	...	...	...	...	...
June ...	...	...	...	...	...	...	...	...	...	...	...	...
July ...	...	...	...	...	...	...	...	...	...	...	...	...
August ...	...	...	...	...	...	2	...	2	...	...	...	2
September ...	...	...	...	2	...	2	...	1	...	3	...	4
October ...	...	...	1	5	1	1	...	3	2	3	2	6
November ...	...	...	...	...	...	...	...	...	...	...	...	...
December ...	...	...	...	1	...	...	...	...	...	1	...	1
Total ...	...	...	2	14	1	7	...	10	3	11	3	21



STATEMENT OF AMOUNT OF REVENUE COLLECTED BY W. B. SMITH, REGISTRAR OF MINES, ON THE  
VOORUITZIGT ESTATE DURING THE YEAR ENDED 31<sup>ST</sup> DECEMBER, 1882.

[G. 34—'83.]

MINE OR DIGGING.	CERTIFICATES OF REGISTRY OF CLAIMS.			CERTIFICATES OF TRANSFER OF CLAIMS.			CERTIFICATES OF HYPOTHECATION OF CLAIMS.			SALE OF ABANDONED CLAIMS.			MINERS' CERTIFICATES.			TOTAL.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Kimberley Mine...	2571	10	0	83	10	0	154	0	0	...	...	...	2809	0	0			
De Beer's Mine ...	3854	15	0	317	5	0	75	10	0	...	...	...	4247	10	0			
St. Augustine's Mine	282	0	0	34	0	0	...	...	...	...	...	...	316	0	0			
Otto's Mine ...	1092	0	0	144	10	0	...	...	...	...	...	...	1236	10	0			
Taylor's Digging	158	10	0	3	10	0	...	...	...	1	0	0	163	0	0			
Miners' Certificates	...	...	...	...	...	...	...	...	...	...	...	97	5	0	97	5	0	
Totals	7958	15	0	582	15	0	229	10	0	1	0	0	8869	5	0			

D

Kimberley, 7th February, 1883.

(Signed) WM. B. SMITH,  
Registrar of Mines.



## [ II. ]

STATEMENT SHOWING THE NUMBER OF HOLDINGS, &c., IN THE  
MINES AND DIGGINGS IN THE VOORUITZIGT ESTATE.

MINE OR DIGGING.	NUMBER OF HOLDINGS.				Total No. of Claims and Portions for which Licence is paid.	Monthly rate of Licence or Registration.	No. of Miners' Certificates issued in 1882.
	By Companies.		By Private Persons.				
	No.	No. of Claims and portions.	No.	No. of Claims and portions.			
Kimberley Mine ...	16	390	19	95	485	s. d. 10 0	} 122
De Beer's Mine ...	17	639	16	34	663	10 0	
St. Augustine's Mine ...	...	...	3	90	90	10 0	
Otto's Mine ...	...	...	852	852	852	10 0	
Taylor's Kopje ...	...	Aban	doned.	...	...	...	

(Signed) WM. B. SMITH,  
Kimberley, 7th February, 1883. Registrar of Mines.

## [ III. ]

PROSPECTING LICENCES ISSUED BY THE DISTRIBUTOR OF  
STAMPS, KIMBERLEY, DURING THE YEAR 1882.

1882.								£	s.	d.		
January.	...	...	H. J. Hoole	...	...	3 months	...	...	3	0	0	
„	...	...	D. Meyer and P. Graaff	2	„	...	...	...	3	0	0	
„	...	...	D. du Toit	...	...	3	„	...	...	3	0	0
May.	...	...	H. J. Hoole	...	...	3	„	...	...	3	0	0
„	...	...	D. Meyer and P. Graaff	2	„	...	...	...	3	0	0	
„	...	...	D. du Toit	...	...	3	„	...	...	3	0	0

(Signed) A. S. VAN COLLER,  
Stamp Office, Kimberley, Distributor.  
7th February, 1883.



## DU TOIT'S PAN.

*The Surveyor of Mines, Du Toit's Pan, to the Commissioner's Office.*

Surveyor of Mines Office, Du Toit's Pan,  
February 28th, 1883.

The Hon'ble the Commissioner of  
Crown Lands and Public Works.

SIR,—In compliance with instructions contained in your letter of the 25th ultimo, I have the honour to forward the accompanying statement of matters connected with the working of my department.

Having been absent with leave during the greater part of the year, I have not been able to watch the various phases of events which have influenced the fortunes and affected the working of the Du Toit's Pan and Bultfontein Mines during that time; but the statement which I am enabled to lay before you, will convey a correct impression of the state of those mines at the close of the year.

I know not to what extent it may be deemed advisable to enter into matters of detail; and as the manner in which the produce of the mines is raised from the mine to the reef, and thence conveyed to the depositing floors, and there manipulated, has been already described by the Inspector of the Mines and Diggings on the Vooruitzicht Estate in his Report of last year, it would be superfluous to deal with those matters now.

It will be sufficient to say that the manner of working at the Du Toit's Pan and Bultfontein Mines, is practically identical with that adopted at the Kimberley and Old De Beer's Mines, viz.:—That the ground is hauled out from the mine in tubs and trucks, suspended on carriages which run on wires, and conveyed by means of Locomotives, Horse-tramways, and Cart roads to the floors.

In only one instance has a shaft been employed, viz., in the Du Toit's Pan mine by the Caledonian Diamond Mining Company. Messrs. Ochs Brothers have in Bultfontein sunk a trial shaft, but they do not work their claims by means of it.

Attached to this Report are Tables of Statistics most carefully and accurately prepared in accordance with my instructions, by Mr. Potts of my department. From them may readily be obtained authentic information on all matters concerning the Du Toit's Pan and Bultfontein mines, such as the nature and quantity of machinery and gear employed, the sort of fuel used, the source of the water supply, the number of hands engaged, as well as the average quantity of ground hauled from the mine daily, and even an approximate estimate of the quantity of ground excavated from the mines from the time of their being first worked. They also allow of easy comparison between the present state of the two mines.

It will among other things be noticed that at Du Toit's Pan, more overseers have been employed in proportion to the number of natives, than at Bultfontein, the proportions being, relatively, as 16·6 to 10·26. As proper supervision of labour is a matter of such vital importance in order to prevent theft of diamonds, this difference may seem extraordinary, but it is to be observed that at Bultfontein large diamonds are comparatively rare, and therefore the chances of their being found in picking likewise few; consequently less supervision is requisite than at Du Toit's Pan, where large stones are plentiful.

During the past year the additional assistance to the staff of the Mining Department has been attended with good results; I allude to the appointment of the Inspector of Machinery\* and the additional subordinate staff of the mining constables granted in October last.

\* *Vide* Appendix C.



From a statement of machinery in position at the Kimberley, De Beer's, Du Toit's Pan and Bultfontein Mines, which has been forwarded to me by the Inspector of Machinery, I find that the engines at Du Toit Pan and Bultfontein, by far outnumber those at the other two mines. The washing gear lately erected at Bultfontein, by the Bultfontein Mining Company, is by far superior to anything yet seen on the Diamond-fields.

I append detailed lists of accidents which have occurred in the two mines during the past year; and I do not think that the number is very great, the extent of the mines and the nature of the work being taken into consideration.

I have issued general orders, which, if properly respected, are calculated to lessen the chances of injury to person; but the difficulty lies in the recklessness of the miners themselves, who, by familiarity with danger, are apt to treat it with contempt, and suffer in consequence.

During the past year the work has greatly fallen off. The causes of this appear to me to be:

Firstly. The want of foresight on the part of Companies in not providing adequate reserve funds for the continuous working of their claims. Secondly, the low price of diamonds. The expenses of working are very great on account of the cost of heavy machinery, and its transport to the Diamond-fields, the high price of fuel (caused by the suicidal efforts of the various companies to outbid each other), the high rate of wages maintained so steadily by the natives, and the expenses of long lines of tramways which the great distances of the depositing floors from the claims necessitate. All these things tend to render diamond-digging a most precarious occupation, so much so that many of the large companies have been obliged to discontinue work; above all, is the system of wholesale robbery which has been pursued for so many years with impunity, and which it is believed has never been carried on on a greater scale than at present. This has ruined hundreds, and has operated more than anything else to the stoppage of work.

Possibly, now that the "searching system" is to be carried out, the loss of diamonds from this cause may be reduced to a minimum, and a happier state of things be inaugurated.

This being the first opportunity which has been afforded me of reporting fully upon all matters connected with the mines in my charge, a short description of their locality and an account of the circumstances which have affected them may not be out of place; and I will endeavour to lay before you my views as to the effect of the existing laws on the working of my department, and to suggest such amendment as appear to me to be desirable.

I have, &c.,

(Signed)

H. J. YONGE,

Surveyor of Mines, Du Toit's Pan and Bultfontein.

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#### GENERAL DESCRIPTION OF THE LOCALITIES OF THE DU TOIT'S PAN AND BULTFONTEIN MINES.

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The Du Toit's Pan and Bultfontein mines, as considered with reference to the Kimberley and Old De Beer's mines, lie to the South-east of these, and at the following distances from centre to centre, viz. :—

Du Toit's Pan from Kimberley, 4,884 yards nearly.

Do. do. De Beer's, 3,608 do.

Bultfontein from Kimberley, 4,972 do.

Do. do. De Beer's, 4,048 do.

From the centre of the Du Toit's Pan mine to that of the Bultfontein mine is about 1,288 yards.



## DU TOIT'S PAN MINE.

The Du Toit's Pan mine (which derives its name from the lake or "pan" which lies to the Southward of it, at a distance of about 600 yards) is situated on the farm Dorstfontein, the property of the London and South African Exploration Company (Limited), and that portion which has been laid out in claims, and generally worked, contains 31 acres, or about 1,490 claims of 900 square feet each.

## BULTFONTEIN MINE.

The Bultfontein Mine is on the farm "Bultfontein," which is also the property of the London and South African Exploration Company (Limited), and its full area is not known (the reef not having been discovered on all sides), and it is supposed to extend to a considerable distance in the direction of the Du Toit's Pan mine, which it may perhaps even join.

That portion which has been worked comprises 1,049 claims, or about 22 acres.

## MINING AREA.

The two mines, together with the sites allotted for working them, extend 4 miles from north to south, and 2 miles from east to west, and actually cover 2,601 acres, or upwards of 4 square miles.

The "pan" above referred to has proved very useful of late years in supplying water for washing the excavated ground: those claimholders who use it, paying a rental to the proprietors.

## THE TOWNSHIPS.

Near the mines, and indeed so close to them as materially to cramp the operations of the claimholders, are the townships of Du Toit's Pan and Bultfontein, the former being to the south of the Du Toit's Pan mine, and consisting mainly of one street lying east and west, and at the western extremity cutting off a portion of the mine.

The township of Bultfontein is on the western side of the Mine of that name, and also consists principally of one street which, however, runs north and south, and meets the main street of Du Toit's Pan at about 190 yards from the south-western extremity of the mine of that name.

Between this point and Kimberley lies the new township of Beaconsfield, which is well situated, being almost equidistant from the two mines Du Toit's Pan and Bultfontein, and at such a distance from them as not to interfere with their proper developments.

This township has been laid out in rectangular blocks. The main thoroughfare, which leads from Du Toit's Pan through the market-square of the new township, lying almost in a direct line between the junction of the main streets of Du Toit's Pan and Bultfontein, and the Kimberley mine.

At a distance of 700 yards from the junction before mentioned, and immediately beyond the north-western extremity of Beaconsfield, the ground rises rather rapidly for a short distance, and thence ascends gradually to Kimberley.

The market is still held at Du Toit's Pan, and during the past few years the number of wagons bringing produce and fuel, have gradually and steadily increased, owing to the great activity which prevailed in the mines, and high prices have, till lately, been maintained.

## BLANCKENBERG'S VLEY.

To the north-east of Du Toit's Pan mine and at a distance of about 2,000 yards from it, is Blankenberg's Vley, which supplies water for washing purposes to some of the Companies.

Having thus detailed the general position of the Mines, I will proceed to give such an account of each, as may convey a correct idea of the circumstances which have influenced its progress since my appointment to my present office in June, 1874.



## DU TOIT'S PAN MINE.

The Du Toit's Pan mine is by far the largest mine in Griqualand West. Its full extent is not known, as the reef has not been defined at the eastern and south-western extremities.

That portion which has been surveyed by Mr. Minter in the year 1876, and which has been regularly worked, was estimated to contain 31 acres, or in round numbers about 1,490 claims.

Its general direction taken in the line of its length (which is 700 yards), is approximately east and west, with a bend to the south of about 500 yards from its eastern extremity.

Its greatest breadth (which is at about 300 yards from the eastern extremity) is 266 yards; and the least, at the south-west extremity, is 150 yards.

Its depth varies, the greatest being 197 feet from the red soil, and the least being 50 feet from the same, in those claims which have been worked.

The greater number of the claims have been leased to claimholders, but some are held by the London and South African Exploration Company (the proprietors) themselves.

The reason for this mine being less deeply worked than the mines of Kimberley and De Beer's, is that it has had special difficulties to contend with, and these I have endeavoured to enumerate.

They may be briefly summed up as—

1st. The ignorance and want of foresight of the early workers of the mine.

2nd. The greater richness of the Kimberley mine.

3rd. The want of sufficient area for working the excavated ground upon.

From all these causes the Du Toit's Pan mine has, from time to time, been neglected, and occasionally almost entirely abandoned; and it was not till foreign capital was introduced, that people were in a position to work it properly.

When the Du Toit's Pan Digging\* was discovered, diamond digging was a new thing to those on the spot, and was in no way understood; and the industry was followed by persons who had no means at their disposal, to enable them to venture on experiments; the digging was then prosecuted to only a few feet below the surface, and the ground taken from one part of the mine, was sorted, within the mine and heaped up upon neighbouring ground, without regard to the value of the ground thus encumbered; this process naturally entailed a heavy burden on future workers.

When the "New Rush" (now Kimberley mine) was discovered, many of the Du Toit's Pan diggers flocked there. Luckily for the "New Rush," the Inspector (Mr. Finlaison) was able to apply there, the experience which he had gained at Du Toit's Pan, and consequently took precautions for the future welfare of that mine, by laying it out square, and making provision for working.

The "New Rush" being remarkably rich, Du Toit's Pan suffered by reason of the superior attractions of its rival; and, it was not until the year 1874, that any real progress or improvement in its condition was effected.

Prior to that time the affairs of the digging (as it was then designated), were controlled by a diggers' committee, formed in accordance with the provisions of Proclamation No. 71 of 1871.

Their efforts to arrest the evil which was being brought about by those sorting on diamondiferous ground, were resisted, and the committee dissolved.

On June 1st, 1874, Ordinance No. 10 of 1874 was promulgated, and the affairs of the mine were placed under the control of a "Surveyor" (myself) as Government Officer, and a Mining Board, consisting of nine claimholders; at this time there was no plan of the mine, and it was impossible under the system of registration then employed, to discover from any licence or other

\*It was not till June, 1874, that Dutoitspan was declared to be a mine. (*Vide* Proclamation No. 7 of 1874).



document, the boundaries of the several claims, so that each digger practically could work where he liked, and in as many claims as he liked under one and the same licence.

I endeavoured to rectify this by calling upon claimholders to point out their claims; and by making notes, and taking observations of their positions, I was enabled to fix their locality. I then stopped the sorting in the mine, a necessary step towards ensuring the future prosperity of the mine.

At this time a considerable portion of the deeply worked ground was under water, and the first care of the Mining Board was to endeavour to have the water removed; and in order to effect this purpose, it entered into contracts, and paid £1,000 per month.

To pay this, heavy taxes were imposed on the claims. Those which were under water paid 50s., those 25 feet above water, 25s., and those under rubbish, 10s. per month.

These taxes proved so burdensome, that many persons abandoned their claims in consequence, and went to the "New Rush" to better their fortunes by searching for diamonds in the débris surrounding that mine. Some few, whose claims were not heavily taxed, and who had good reason to believe in the richness of the ground, remained and took out as much ground as could be allotted to them under the Ordinance.

At this time only ten claims could be held by a digger, and this restriction rendered it difficult to work the mine satisfactorily, as the immense heaps of rubbish on the claims, made it difficult to work in so small an area as ten claims.

The Government, at the instance of the Mining Surveyor, assisted the work of clearing the mine, by sending convicts to cut openings through the débris into the mine, and to construct roads within it. By means of these roadways the débris and other ground was carted out.

These roads proved useful till the year 1880, when the mode of working was abandoned in favour of hauling.

During the year 1875, so complete was the desertion of the Dutoitspan Mine, that on many occasions, blocks of claims have been marked out for those to whom they have been allotted, and these have not considered them worth the licence money for one month. These claims have since been put into Companies at upwards of £1,000 each.

In the year 1876, many débris washers from the New Rush came to Dutoitspan, and by degrees took out claims in the mine, and by working steadily developed it.

After the abolition of the 18th Clause of the Schedule to Ordinance No. 10 of 1874, in the year owners of ground amalgamated their claims, or sold them to others who wished to form large blocks, and thus the mine began to be more systematically worked, than had previously been the case.

Good substantial machinery of considerable value was erected and the debris was rapidly removed from the mine; and whereas in 1874 the interior of the mine was to the extent of two-thirds covered with heaps of rubbish, in some places forty feet high, there remains scarcely a single claim with rubbish on it.

When I took charge of the mine in 1874, the most powerful machinery erected on the margin of the mine was the windlass which hauled up the ground in small zinc or leathern buckets, containing about  $\frac{1}{20}$  of a load of 16 cubic ft. each, hauling about 16 loads per diem at most. At the close of the year 1874, it had to give way to the whim and the whip, both of which were worked by horse-power. These in their turns became unequal to the work to be done, and were superseded by steam engines.

\*By reference to the accompanying table of statistics it will be seen that 49 hauling engines, with an aggregate power of 663 horses, are erected around the mine; and although, owing to the peculiar circumstances of the time, only 27 of these were at work at the close of the year, the quantity of



ground hauled by them daily amounted to 202,409 cubic feet, or  $15,150\frac{9}{16}$  loads of 16 cubic feet each.

Besides these there were 42 washing engines of altogether 443 horse-power, of which 26 engines of altogether 264 horse-power were at work.\*

The reason, or certainly one of the principal reasons, why the mounds on the margin of the mine still exist, is that the area proclaimed for mining purposes in the year 1874 was so inadequate to the requirements of the mine, that the ground excavated could not be worked on the space allotted, without its being heaped up.

The ground was not sufficiently rich to allow of the claimholders renting, at the ruinous rate then demanded by the proprietors of the farm, depositing or working sites outside the prescribed limits; and so, by degrees, the mounds rose higher and higher till they reached their present proportions.

As experience taught the claimholders improved methods of working their ground, and as powerful machinery, and therefore an increased output of ground, necessitated increased facilities for removing the rubbish, tramways were laid down, and the high mounds, already referred to, were utilised as embankments for these tramways.

In the year 1881, an agreement was arrived at by the proprietors of the farm, and the claimholders, not only with respect to a more satisfactory tenure of their claims, but also as to increased facilities for spreading out the excavated ground; and in conformity with this agreement depositing sites have been allotted to each claimholder by a committee appointed for that purpose.

The sites are allotted in the proportion of one acre to each claim, and for this a sum of £1 per month per acre is charged.

To these depositing sites, tramways lead from the hauling sites, and although, owing to the bad dispositions made in the early days as to the location of the township, these sites are necessarily situated at great distances from the mine, there is no doubt that without them the mine could not be worked, as the blue ground taken from the mine, requires long exposure to the atmosphere.

† In connection with the Dutoitspan mine there are 4 miles of broad gauge tramway (30'') and sixty-four and a quarter miles of narrow gauge (18''), making a total length of sixty-eight and a quarter miles of tramway.

With regard to the richness of the Dutoitspan mine as compared with others, it is to be observed that although the diamonds which it produces are not so plentiful as those of Kimberley and De Beer's mines, they are far superior to them in quality, next in value come those of Bultfontein, then those of Kimberley.

It is difficult to speak with any degree of accuracy of the value of the mine, for that depends upon so many contingencies, among others, upon the depth to which it may be possible to work it, and the estimation in which diamonds are held. Those who have experienced the fluctuation or, shall I say, the steady and rapid fall in the value of these gems during the last few months, will agree with me that any valuation of the mine must be purely imaginary, the most that can be arrived at, is the probable merits of the mine as an investment. Seeing the great, not to say insuperable difficulties, which prevent the most experienced diggers from arriving at a correct and just estimation of even the relative value of the different blocks in the mine, it would be presumptuous in me to make any decided statement as to the value of *the whole mine*.‡

It would also, I conceive, be improper to remark upon the relative richness of the several parts of the mine, not only for the last-mentioned reason, but also, because I should be, as it were, advertising some at the expense of others.

\* The value of machinery in position (exclusive of washing gear, wires, jumpers, &c., &c.) at Dutoitspan is estimated at £100,000.

† The rails for tramways at Dutoitspan (exclusive of the expenses of laying and of sleepers, &c., &c.) are valued at £37,440.

‡ It is generally estimated that the yield is one carat per 4 loads.



It is not to be supposed that all the ground in the mine is remunerative, on the contrary, in Dutoitspan mine there is a considerable quantity of floating reef (as it is termed). This being a mass of rocks intermixed with thin layers of diamondiferous ground, in some places reaching to a depth of 70 or 80 feet from the original level. The cost of working this floating reef (which is totally unproductive) has deterred many companies from touching it, the consequence being that some portions of the mine which are covered with this still remain, within a few feet of the original level, the companies not having sufficient capital to clear it off. Several companies, which I will refrain from naming, have during the past two years cleared off an enormous quantity of floating reef, to the serious detriment of their financial position.

At a depth of about 50 feet in the mine, water is met with perculating from the main reef, and is drained in most instances by means of pumps driven by wire ropes, the engines standing on the upper level adjoining the hauling engines, the water thus pumped up being utilized for washing purposes, supplying boilers, &c., &c.

At the present moment (as indeed was the case at the close of the last year) the greatest accumulation of water is in the claims of the Anglo-African Company, where a pumping engine, capable of delivering about 9,000 gallons per hour, is fixed. This engine works day and night, all the year round, delivering an average of 5,000 gallons per hour, the water is used by the aforesaid Company for washing purposes, and for watering the blue. The cost of this work of drainage is estimated at £10,000 per annum.

The main reef has not as yet given trouble to the diggers; but it is to be feared that as the depth increases it will do so. As far as can be seen the reef is of much the same nature as that of Kimberley, part being friable rock, part black shale, and in places hard blue conglomerate very tough and difficult to dislodge, of the same substance as the main reef on the north side of De Beer's mine.

The question of providing means for working down dangerous main reef, is one which will have to be faced sooner or later.

For this no provision has yet been made, and there seems to be a general disinclination to deal with the matter.

The Mining Board having long ceased to exist, there were, at the close of the year 1882, no taxes, and no representative body entitled to deal with such questions as the above.

The rates of the wages obtained by the several classes of workmen in the mine may be generally stated thus:—

Mechanics ...	...	...	£8	0	0	per week.
Engine Drivers ...	...	...	£6	0	0	„
Blasters ...	...	...	£6	0	0	to £7 0 0 per week.
Overseers ...	...	...	£5	0	0	to £6 0 0 „
Cart Drivers ...	...	...	£2	0	0	per week.
Natives ...	...	...	£1	10	0	„



## LIST OF ACCIDENTS IN DUTOITSPAN MINE, 1882.

Date.	Name of Company.	Nature of Accident.	Killed.		Injured.		Remarks.
			White.	Native.	White.	Native.	
Feb. 15	Hercules ..	Fall of Carriage off Wires.. ..	..	..	..	1	Leg injured.
Mar. 4	..	Explosion of Gun Cotton ..	..	..	1	1	Slight.
Mar. 13	Britannia ..	Fall of Ground ..	1	..	..	..	
Apr. 3	Fry's Gully..	Blasting .. ..	..	..	1	..	Leg broken.
Apr. 7	Dutoitspan ..	Breaking of Hauling Wire ..	..	..	..	1	" "
Apr. 13	Victoria ..	Explosion .. ..	..	..	1	..	Slight injuries.
May 12	Anglo-African	Tips .. ..	..	..	..	1	Leg broken.
Aug. 18	Do. do.	Collision with truck	1	..	..	..	
Aug. 21	Do. do.	Collision at Tips..	..	..	..	1	Leg broken.
Aug. 29	Kimberley ..	Fall of Stone from Tub .. ..	..	..	..	1	" "
Sept. 8	Anglo-African	Fall of Ground from Tub .. ..	..	1	..	..	
Sept. 22	Do. do.	Fall of Ground from Phoenix Company during blasting hours	1	..	..	..	
Oct. 3	Derby and Halifax	Slip of Ground ..	2	1	..	7	Slightly injured.
Nov. 28	West-End ..	Fall of Ground ..	1	..	..	..	
Dec. 15	Anglo-African	Ground falling from Ledge ..	..	..	..	1	Arm broken.

Number of Accidents causing Death .. .. 6

Number of Accidents causing Injury .. .. 9

Total number of Accidents .. .. 15

	Killed—White. Native.		Injured—White. Native.	
Total .. ..	6	2	3	14
Grand Total .. ..	8		17	

(Signed) H. J. YONGE,  
Inspector of Mines.



## BULTFONTEIN MINE.

Before the passing of Ordinance No. 10 of 1874, Bultfontein digging had been governed by a Diggers' Committee, constituted in accordance with the provisions of Proclamation No. 71 of 1871, but the Committee had ceased to act for some time past, when Ordinance No. 10 of 1874 was promulgated.

By virtue of Ordinance No. 10 of 1874, Bultfontein became an *established digging*, and two officers—an Inspector and an Overseer—were appointed for its management.

At this time very few people, principally Kaffirs, were working there, and what work had already been done had been carried on in a most irregular and unsystematic way. The débris taken from one place had been heaped on another, and no boundary lines of any sort, were perceptible. The only ground which was not covered with rubbish, was that in the immediate vicinity of the homestead and, the Central Road which traversed the digging.

There was no plan in the Inspector's office by means of which the position of any claim could be proved; so that any person, the holder of one licence, could, without fear of discovery, work several claims under cover of that licence. The Revenue suffered accordingly.

In the year 1875, when I held the position of Inspector, the Government, at my instance, employed a Government Surveyor (Mr. A. Bovill) to lay out the digging in square claims of nine hundred square feet each.

He experienced considerable difficulty in inducing the diggers to abandon their old irregular boundaries (if boundaries can be said to have existed) in favour of the new, but as, at about this time, many white men took out claims, and bought others from those holding them, they appreciated the advantages resulting from accurate definition of the limits of property, and accepted the new lines which still regulate the boundaries of claims at Bultfontein.

The digging was numbered in accordance with a system which had not till then been employed. By means of this system the position of any claim can readily be ascertained, as it is designated by the intersection of two lines, one of which is denoted by a figure, and the other (which cuts it at right angles) by a letter; so that no reference to any plan or drawing is necessary, the very number of the claim conveys a knowledge of its position.

This system has been adopted in the new mines of Jagersfontein (as newly laid out) and Koffeyfontein, if not in others, and should, I think, be adopted wherever claims are marked out in squares.

It was some considerable time before the value of the Bultfontein ground became generally known, but those working in the digging, by degrees acquired large blocks of claims, and eventually speculators, and after them large capitalists, who bought the ground with a view to working it, took up claims.

From this time the digging steadily improved.

Having the experience of Kimberley and Dutoitspan before me, I took the opportunity which the regularity of the boundaries afforded, to lay out roads for the working of the claims on each side of them. On certain lines a portion of each claim 7' 6" in width, was reserved for these roadways. These roads enabled the claims to be worked to a considerable depth. The main central road proved of the greatest benefit as being 15 feet in itself, the portions 7' 6" on each side, added to it, made a good road 30 feet wide. From this, branch-roads led. This road had to be lowered at various times, and only when it had reached a depth of 40 feet from the red soil, and the claims had reached a depth of about 70 feet, and carting ceased to be remunerative, were the roads generally abandoned.



Then whims and engines were erected; and now, some of the finest machinery on the diamond-fields stands at Bultfontein.\*

There are at Bultfontein 29 hauling engines, with an aggregate power of 378 horses. Of these, at the close of the year, only 18 engines, with in all 238 horse-power were at work.

The quantity of ground hauled by these 18 engines, amounted to about 151,580 cubic feet (or about  $9,473\frac{1}{2}$  loads of 16 cubic feet each) daily.

The blocks of claim held are, in most instances, larger than those at other mines, and they are being worked very systematically and evenly. The average depth of the mine† is 126 feet, which is greater than that of Dutoitspan.

Round the margin of the mine, is a circular road of 30 to 40 feet in width, and outside this, on slight elevations, is erected the machinery.

In very few instances is washing carried on near the hauling gear, almost all the Companies removing the ground from the depositing box to the depositing floors in trucks running on tramways, of which there are 7 miles of broad (30") gauge, and 34 miles of narrow (18") gauge, making a total length of forty-one miles of tramways.‡ Three Companies, viz.: the "Adamant," the "Homestead," and the "Bultfontein Mining Company," make use of the locomotives for the removal of their ground, and of these, the two first-mentioned Companies have one each, and the lastmentioned three.

Since the passing of Ordinance No. 10 of 1874, Bultfontein digging has never had a mining board, or any other body for regulating its affairs. The whole duty of arranging these matters devolved on the Inspector.

In order to improve the communications inside and outside the digging, and to work down threatening reef, a tax had to be imposed. This has proved very useful, and had the rate been higher, a considerable amount of reef, which must prove a serious obstacle in future years, might have been removed. The rate now is 6s. per month per claim.

I commenced to remove the reef at certain points of the mine, and intended carrying out the terraces round the mine as it is the system adopted at Kimberley, but my efforts in the way of improvement were rendered of no avail, owing to the opposition of a certain number of the claimholders, who objected to pay a higher rate, or indeed any at all.

Aware of the great expense which removing water by contract had entailed on the Dutoitspan Mining Board, I considered that it would be to the advantage of the claimholders that when water became an impediment to the working of the digging, they should be in a position to remove it by means of their own machinery, and I therefore, as Inspector, imposed a machinery rate for the purpose of providing funds for the purchase of machinery; as the water has not proved a source of trouble no machinery has been bought and the funds collected remain at the disposal of the claimholders.

The yield of ground in the Bultfontein mine is rather greater than at Dutoitspan, being about  $\frac{1}{3}$  carat per load.

The diamonds are nearly all white, and generally small, though occasionally large stones are found.

There are, in certain portions of the mine, large masses of floating reef, such as has been described in my report on the Dutoitspan mine. These appear to be in ridges generally north and south.

\* The value of the machinery in position alone (exclusive of washing gear, wires, jumpers, &c., &c.,) is estimated at £60,000.

† Bultfontein was declared a mine by Proclamation No. 210 of 1882

‡ The rails for tramways at Dutoitspan (exclusive of the expenses of laying, and of sleepers, &c., &c.,) are valued at £23,000.



The rates of wages obtainable by workmen may be stated generally thus :—

Mechanics ...	...	...	£8	0	0	per week.
Engine Drivers ...	...	...	£6	0	0	„
Blasters ...	...	...	£6	0	0	to £7 0 0 per week.
Overseers ...	...	...	£5	0	0	to £6 0 0 „
Cart Drivers ...	...	...	£2	0	0	per week.
Natives ...	...	...	£1	10	0	„

(Signed) H. J. YONGE,  
Surveyor of Mines.

February 28th, 1883.



## LISTS OF ACCIDENTS IN BULTFONTEIN MINE, 1882.

Date.	Name of Company.	Nature of Accident.	Killed.		Injured.		Remarks.
			White.	Native.	White.	Native.	
Feb. 7	Mr. Vigne's Claims	Carriage off Wires	..	..	..	1	Leg injured.
Feb. 14	Alliance ..	Explosion ..	..	..	..	1	Face injured.
Feb. 28	Equitable ..	Fall into Shaft ..	..	..	..	1	Face and body injured.
Mar. 5	Homestead ..	Breaking off shackle whilst tightening Wires ..	..	2	..	..	
Mar. 9	Ochs Bros. ..	Explosion small charge ..	..	..	1	..	Face injured.
Mar. 28	Bultfontein Co.	Fall of stone from main reef ..	..	..	1	..	Severely.
Apr. 6	C. Milchint ..	Explosion of powder ..	..	..	1	..	Slightly injured
Ap. 24	Alliance ..	Breaking of standing wire ..	..	..	..	1	Head smashed.
Ap. 25	Bultfontein Co.	Accident in tunnel blue ground falling from above ..	..	..	1	..	Arm broken and head smashed
May 3	Bultfontein Co.	Crushed at tips ..	..	..	1	..	Broken ribs.
May 15	„ ..	Blasting ..	..	..	..	1	Arm broken.
Nov. 11	French and D'Esterre	Ground falling out	..	..	..	1	Buried.
Dec. 5	Bultfontein Co.	Fall of Ground from Tub ..	..	..	..	1	Broken Leg.

Number of Accidents causing Death .. .. 1  
 Number of Accidents causing Injury .. .. 12

Total Number of Accidents .. .. 13

	Killed—White. Native.		Injured—White. Native.	
Total .. ..	0	2	5	8
Grand Total .. ..	2		13	

(Signed) H. J. YONGE,  
 Inspector of Mines.



## APPENDIX A.

Chief Inspector of Mines Office,  
Kimberley, 9th February, 1883.

No. 28/83 C.]

The Inspector of Mines, Dutoitspan.

SIR,—In reply to yours of the 5th instant, I have the honour to answer your queries in summarized form below, and beg to repeat at this opportunity, that the substance of your questions is answered at great detail in the Report I have lately been very fully engaged with for the Government.

A copy of this Report will be at your service for perusal, if you wish to see it, say, in ten days from this date.

1. I consider the character of the Machinery at Dutoitspan and Bultfontein Mines as generally suitable for the work to be dealt with, though, in the case of the inclined aerial hauling gears, they are more precarious and uneconomical in regard to amount of fuel used, in comparison with average results obtained in the systems usual in other parts of the world of hauling up vertical shafts.

The general quality and workmanship of the engines and boilers, mostly in vogue here, *i.e.*, semi-portable multitubular boilers of the locomotive type, with engines both combined and separate, when new, are usually equal to fair, and sometimes the best, English practice, but they deteriorate owing to inattention to inward cleaning (I refer especially to boilers) much faster than the weakening effects of corrosion, and wear and tear ordinarily affects them.

The water available for feed water in this district is very highly charged with lime, which deposits in dangerous amount in the boilers very quickly; thus, I have to find fault with neglect of systematic examinations by Companies of the interior of boilers.

Now that boilers are "ageing," I apprehend that danger from this former neglect is becoming day by day more appreciable, and I recommend in my Report certain regulations to be observed by steam-users.

2. From my notices for safety, which you countersigned and kept copies of, for your reference in your office, you will notice that I have found in a large number of cases—

- a. Revolving machinery in exposed places, quite unfenced.
- b. Many hauling and standing wires in a most dangerous condition and quite unfit for work.
- c. Boiler-mountings very often in a defective condition, and from this account persons' lives certainly placed in jeopardy.
- d. No system (as above) for periodically examining the interior of boilers, &c., &c. I cannot therefore say that uniform precaution obtains on the part of owners of machinery, though I must express satisfaction at having found a general readiness on the part of Mining Companies, and others, to immediately attend to my orders or suggestions tending towards better safety.

3. I estimate that probably not one-half of the engine drivers, boiler attendants, etc., employed at these mines would pass muster for such employment in England, but I beg to refer you to a letter of mine addressed to you on the qualifications of engine-drivers, etc., on October 12th, 1882, for a fuller statement on the subject.

I have, &c.,

(Signed) F. SCHUTE,

Inspector of Machinery.

True Copy:

(Signed) H. J. YONGE, Inspector of Mines.



## APPENDIX B.

Laws governing  
Bultfontein and  
Dutoitspan Mines.

The laws governing the Dutoitspan and Bultfontein Mines are the 29th Sec. of Proclamation No. 71 of 1871, and so much of the rules and regulations contained in the Schedule to Ordinance No. 10 of 1874 as have been made applicable by Ordinance No. 15 of 1879.

Powers of  
Mining Surveyor.

Thus, only these parts of Ordinance No. 10 of 1874 which have reference to the powers of the Mining Surveyor and Mining Board, are confirmed.

Clause 9, Sect. II.,  
Ord. 10 of 1874 and  
cl. 4, Sect. V., Ord.  
10 of 1874.  
Sect. I., Ord. 15 of  
1879.

In terms of this Ordinance, the sole and entire control of the whole digging area, or areas, and of the working of the diggings, for the general safety and convenience of the miners, is vested in the Mining Surveyor, in so far as such power shall not conflict with private rights.

Vide Gov. Notice No.  
35 of 1875.

Unfortunately, at the present moment, the limits of the areas referred to in clause 9 Sect. II., and clause 4 Sect. V. of Ordinance No. 10 of 1874, are undefined; for, when that Ordinance was promulgated, the Dutoitspan Mining area was that described as *Area No. 4* in Proclamation No. 6 of 1874, which Proclamation was disallowed by Her Majesty; and since that no new Mining area has been defined or declared.

This is unsatisfactory; for at Dutoitspan (and at Bultfontein also) the proprietors of the farm have given over the control of a zone, of 300 feet in width, to a Committee styled the *Depositing Site Committee*; and, as mining operations are carried on within that zone, it is but proper that the Government officer in charge of the mine, should have control over it as far as safety to life and limb is concerned. If so, and indeed in any case, the limit of his jurisdiction ought to be accurately defined. No doubt there are difficulties in the way of accomplishing this, but it is an end which it is desirable to attain.

Miners.

Another difficulty has on occasions presented itself to me with regard to the *persons* over whom the Mining Surveyor has jurisdiction. It is this:

Throughout Ordinance No. 10 of 1874, except in clause 29, Sect. I.—when the word *person* is used, the orders of the Mining Surveyor are made applicable to *Miners* only, and the word *Miner* is generally held to mean *Certificated Miner* as described in clauses 1 and 2 of Sect. I. of that Ordinance, the importance of the certificate being especially insisted on in clauses 8, 9, 10, 11, 20, 21, and 22.

Now, I have been instructed that at Dutoitspan the possession of a Miner's Certificate by a claimholder, or other person working in the mine, is not obligatory.

If therefore the Surveyor's orders are only applicable to those who possess certificates, and those working in the mine need not have certificates, these working in the mine and who have no certificate, need not obey the orders of the Surveyor. I think that the law might with advantage be made more explicit on this point.

Accredited Agents.

Clause 9, Sect. I. of the Schedule to Ordinance No. 10 of 1874, throws the responsibility of the working of the claims of a company, or firm, on the accredited agent. As a rule these agents take no active part in the management of the working of the claims; and it will be found that they are generally appointed agents less on account of their knowledge of mining than for their business qualifications. Practically, the working of the claims is intrusted to the Working Manager; yet I have been informed by the Clerk of the Peace that the *Accredited Agent* is the person whom the Surveyor must proceed against in case of disobedience of orders. I would propose that the *Working Manager* should be made responsible for the working of the claims of the Company.

Yaled in compliance  
with order of Surveyor.

In terms of clause 26, Sect. I. of Ordinance No. 10 of 1874, the order of the Mining Surveyor has effect *from and after the expiration of twenty-four hours after serving the same.*



This, I consider, militates against the efficacy of the order, or, at least may in certain cases, render it useless for much mischief, which the order was issued to prevent, might be done during the twenty-four hours during which the order is inoperative. Instances have occurred in which, had the recipient of my order deferred compliance for twenty-four hours, many lives would have been sacrificed.

I therefore recommend that *immediate* compliance with the order of the Mining Surveyor be enforced.

Although the general voice of the claimholders of Dutoitspan and Bultfontein has pronounced most emphatically against the institution of Mining Boards, it is still found necessary to invest certain persons with authority to regulate matters specially affecting the mines for which they are appointed; and, as from time to time, questions affecting the general body of claimholders do arise, and must be dealt with, and, as it is proverbial that "what is everybody's business is nobody's business," it becomes necessary to place the power of regulating these matters in the hands of bodies which have the confidence of the community.

*Mining Boards.*

The Schedule to Ordinance No. 10 of 1874 provides for the election of Mining Boards (*vide* Sec. VI.) and it is further provided by clause 13, Sec. VI., that in certain cases a special committee may be appointed for each mine by Government; but I think that I am right in saying that, unless some person unconnected with the mine be selected as its third and unofficial nominee by Government, it may not be at all times possible to appoint such a Committee as is contemplated.

I do not think that the claimholders generally would object to the appointment of *bonâ fide* Government officers to such Committees, although it has been seen that they are unwilling to confide their interests to boards composed of members of their own body; and the fact that no dissentient voice has been raised against the present constitution of the Committees established for the carrying out of the Searching Rules and Regulations (*vide* Proclamation No. 1 of 1883) at Dutoitspan and Bultfontein, confirms me in my conviction that claimholders are better satisfied with a governing body in which are a certain number of Government officers, who have no personal interest or direction of the affairs of any particular company, or block of claims, than with one, consisting entirely of claimholders, the conflicting interests of the several claimholders being thus fairly balanced.

## APPENDIX C.

### THE INSPECTOR OF MACHINERY.

As far back as Nov. 10th, 1879, I recommended the appointment of such an officer, and I think that the adoption of this suggestion, even after so long a delay, has been attended with beneficial results.

As, when large machinery came into general use in working the mines, many of those who had charge of the different blocks of claims, had little or no knowledge of this subject, it is natural to suppose that, in course of time, the machinery would deteriorate, and many precautions against danger would be neglected. By the appointment of the Inspector of Machinery, much additional security is gained; and it is evident, from the numerous orders which Mr. Schute has found it necessary to submit for my counter-signature, that his appointment was highly necessary.

I understand from Mr. Schute that he has prepared for Government, a detailed report of all matters connected with the machinery in use in the mines of Griqualand West. I have, therefore, not thought it necessary to ask him for a full report upon the result of his inspections of the machinery in use at Dutoitspan and Bultfontein.

[G. 34—'83.]

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I have, however, considered it proper to obtain from him, an expression of his opinion upon certain points which are of considerable importance, and upon which it is necessary that I should obtain his judgment—these are:—

1. The general character and quality of the machinery in the Dutoitspan and Bultfontein mining areas.

2. Whether proper precautions are generally observed by owners of machinery for the safety of those employed in their workings.

3. Whether, as a rule, fit and proper persons are placed in charge of the machinery, and, if not, what suggestions he would offer for reform in this particular.

His reply to these inquiries is appended and marked A.

No doubt Mr. Schute has, in his report to Government, suggested remedies for the evils which he has found to exist.

I have thought it especially incumbent on me to draw his attention to two matters, viz., the desirability of securing fit and trustworthy men to take charge of engines, and also the necessity for devising some means of preventing the fall of tubs and carriages from the wires on which they travel.

*Examination of Engine-drivers as to fitness.*

With regard to the former subject, I suggested that no person should be employed as engine-driver within the Dutoitspan and Bultfontein mining areas, unless he possess a certificate of qualification, signed by the Inspector of Machinery, and desired to be informed whether he would undertake with that object the examination of such men as were employed or might present themselves for employment as engine-drivers, and grant certificates to those whom he might find to be qualified.

*Opinion on this point.*

Mr. Schute regards this matter as one of considerable importance, but surrounded with much difficulty.

He is of opinion that the compulsory holding of a certificate of competency by a person employed as engine-driver would be a guarantee, to a certain extent, for the prevention of accidents, but regards such a refinement as compulsory examination in the existing state of affairs in the mining industry, as quite impracticable.

He thinks that such a radical change as I propose, should originate with the general body of miners. He bases this opinion on the assumption that the safety to life and limb of their employes is zealously looked to by employers of labour, and that also the economical working, and "life" of their machinery and gear, would be a sufficient inducement to employers to try to get the best men obtainable, and that, therefore, Companies should satisfy themselves as to the competency of their servants, and, themselves make any arrangements for a test examination as to their experience.

He is also doubtful whether there would be a sufficient number of men coming forward as candidates, and thinks that technical knowledge would count for perhaps more than it is worth, general steadiness and sobriety being undeniable primary qualifications for the drivers for the class of engines used in this mining district, the tendency of the manufacturers having, during latter years, been in a direction of making the manipulations of the gears as simple as possible.

He thinks that preliminary interference by Government Inspectors before danger is shown to exist, would be going beyond the province of their jurisdiction, but he acknowledges that it may safely be said, that the lives of many persons are endangered by the inexperience of those whom I would seek to bring under a compulsory Government examination.

*Remarks thereon.*

With regard to these arguments, I would observe that experience does not bear out Mr. Schute's assumption that the safety of their employes is zealously looked after by employers of labour, that regard for the "life" of their machinery does not induce employers, in all instances, to get the best men, and that, if these reasons be supposed to be sufficient to induce claimholders to look after the lives of those working in the mines, there is scarcely any necessity for official supervision at all.



But instances have occurred in which tubs have been thrown off the wires in consequence of the carelessness, or incompetency, of the engine-drivers, so that interference can scarcely be said to be unnecessary.

The supervision of managers and owners of machinery, is, by no means sufficient guarantee for the qualifications of their engine-drivers, as these persons frequently know nothing whatever about machinery, or what the chief qualifications for the post of engine-drivers are.

In support of this I must quote the letter of Mr. Schute's, dated February 9th, 1883, appended, in which he says that "probably not one-half of the engine-drivers, boiler-attendants, etc., employed in these mines would 'pass muster' in England."

Surely some reform is needed in this direction, and I hope that some measure may be passed which will make it obligatory in persons owning machinery, to entrust the working of it, only to competent hands.

The falling of tubs and cages from their wires, is a very frequent cause of injury to life and limb within all the mines, and this matter is well worthy of all the attention that can be bestowed on it.

*Falling of tubs.*

The proper care of explosives is a matter which deserves the most serious consideration, and I have observed great carelessness and indifference, on the part of those who chiefly have to use them.

I would therefore gladly welcome any regulations, issued by Government, which would tend to give greater security in this direction.

I think that the subject should be specially treated, and considered in the framing of any new Mining Ordinance.

(Signed) H. J. YONGE,  
Surveyor of Mines.

Dutoitspan,  
Feb. 28th, 1883.

#### DIAMOND MINES AND DIGGINGS IN THE DIVISION OF BARKLY.

Having in a former Report given full particulars concerning the Diggings, dry and alluvial, situate in this Division, it will scarcely be necessary to travel over the same ground again, but a few remarks on the diamond industry during the year 1882 may probably be not uninteresting.

The Revenue received on account of Diggers' Licences from the various diggings during the year ending 31st December, 1882, amounted

to ... ..	£2,996 10 0
From Miners' Certificates	294 15 0
Transfer of Claims	35 0 0
Fee accredited Agent	0 10 0
in all a total of	£3,326 15 0

The enormous decrease in the Revenue from that of 1881 is attributable to the abandonment of claims by all the River Companies, and the fact that in the dry diggings of Victoria and Newlands No. 1, there has been a complete cessation of all work, and no licences have, for a very considerable period, been renewed.

The alluvial diggings (as worked by the individual digger) compare favourably as regards the Revenue for 1882 with that of 1881, despite the fact that during the latter year (1882) many diggers (since returned) left to try their fortunes at the new Gold-fields.



During the year 1882, Newlands No. 2, a dry digging situated on a farm (belonging to Mr. Poton) on the Hartz River, was proclaimed and partially allotted, but, like its sister digging, Newlands No 1, it has but a limited number of claims (about 12) free of what appears to be called sandstone, and beneath which it is supposed the real mine lies, and it is to this fact alone that but a limited number of claims were, on the day of allotment, applied for and given out. At present there are only 12 claims in the whole digging upon which licences continue to be paid.

PROSPECTING.

Prospecting for new diggings during 1882 has not been prosecuted with such zeal as in the preceding year. Still there are two prospects possibly worthy of notice; one already before the Government, the other yet to come. The latter looked upon with growing interest by many; as it is thought, judging from the nature of its diamondiferous soil, success will in all probability attend the enterprising prospector.

(Signed) W. FRANKLIN, Inspector of Claims.

Barkly, Griqualand West.

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“ DUPLICATE.”

DUTOITSPAN AND BULTFONTEIN MINES.

SUMMARY OF MEMORANDA of Statistics of the different Companies and Claimholders working the above Mines on 1st January, 1883.

DUTOITSPAN MINE.

AREA OF MINE, 31 Imperial Acres, or 1,490 Claims.  
LENGTH OF MINE, 700 Yards.  
GREATEST BREADTH, 266 Yards.  
LEAST Do., 150 Yards.  
DEPTH OF MINE, from 50 to 197 Feet.

BULTFONTEIN MINE.

AREA OF MINE, 22½ Imperial Acres, or 1,049½ Claims.  
LENGTH OF MINE, 382 Yards.  
GREATEST BREADTH, 363 Yards.  
LEAST Do., 94 Yards.  
DEPTH OF MINE, from 60 to 180 Feet.

Companies working and not working.		Number of Companies	Number of Engines and Horse Power.		Number of Locomotives.		Number of Whims.		Description of Gears.		Mode of Conveyance to Floors.			Length of Tramways.		Total Mileage Tramways	Fuel used by Gears.				Water Supply.				Standing Wires. Size in diameter.		Hauling Wires. Size in diameter.		Description of Ground being hauled.		Size of Tubs and Trucks.		Labour at present Employed.			Quantity of Ground now being hauled.		Number of Claims.	Approximate Quantity of Cubic Yards Solid that has been excavated since commencement of Mine.	
			Number of Engines.	Horse Power.	Number of Engines.	Horse Power.	Whims.	Horse Power.	Cage Gears.	Tub Gears.	Locomo- tives.	Horse Tramways	Carts.	No. of Miles Broad Gauge 27'	No. of Miles Narrow Gauge 18'		Coal.	Coal and Wood.	Wood.	Wood and Cordung.	Mine.	Pan.	Wells.	Blancken- berg Vley.	Gears with 1" and upwards.	Gears with under 1"	Gears with ½" and upwards.	Gears with under ½"	Gears hauling Blue.	Gears hauling Yellow.	Gears hauling 20 cub. ft. and upwards.	Gears hauling under 20 cub. ft.	Mechanics.	Overseers.	Natives.	No. of 16 cub. ft. Loads hauled daily.	Containing cub. ft. hauled daily.			
DUTOITSPAN.																																								
Companies working	..	21	65	719	2	8	..	..	4	23	2	19	..	4	64½	68½	9	6	9	3	10	4	11	2	23	4	27	..	20	7	9	19	103	315	3,235	15,150,½	242,209	1,083	Cubic Yards Solid.	
Do.	not working	10	45	495	2	16	2	6	1 Shaft	20	2	12	5							..	..	..	..	5	2	6	3	16	5	16	4	17	5	6	13	..	..	..	..	407
Totals		..	23	110	1,214	4	24	2	6	5	43	4	31	5	4	64½	68½	9	6	9	3	15	6	17	5	39	9	43	4	37	12	15	32	103	315	3,235	15,150,½	242,209	1,490	5,401,440
BULTFONTEIN.																																								
Companies Working	..	16	45	466	2	18	2	8	2	17	2	11	7	7	34	41	..	9	7	..	..	4	12	..	16	3	19	..	18	1	8	8	88	161 and 25 European Labourers.	2,685	9,473½	151,580	572½	4,472,160	
Do.	not working	7	27	254	1	8	4	9	1	14	1	4	9				..	..	..	..	..	..	..	3	1	3	..	9	6	12	3	12	3	..	7	..	..	..	477	..
Totals		..	23	72	720	3	26	6	17	3	31	3	15	16	7	34	41	..	9	7	..	3	5	15	..	25	9	31	3	30	4	8	15	88	161	2,685	9,473½	151,580	1,049½	4,472,160

TOTALS OF THE TWO MINES.

Totals working	..	37	110	1,185	4	26	2	8	6	40	4	30	7	} 11	98½	109½	9	15	16	3	10	8	23	2	39	7	46	..	38	8	17	27	191	476 and 25 European Labourers.	5,920	24,624½	393,789	1,655½	9,876,600
Do. not working	..	17	72	749	3	24	6	15	2	34	3	16	14		..	..	..	..	..	..	8	3	9	3	25	11	28	7	29	8	6	20	..	..	..	884	..		
Grand Totals	..	54	182	1,934	7	50	8	23	8	74	7	46	21	11	98½	109½	9	15	16	3	18	11	32	5	64	18	74	7	67	16	23	47	191	476 and 25 European Labourers.	5,920	24,624½	393,789	2,539½	9,876,600

IN DUTOITSPAN MINE THERE ARE

49 Hauling Engines equal to 663 Horse Power.  
42 Washing Engines do. 443 do. Of these 25 of the Boilers perform the double work of Washing Ground and Pumping Water.  
19 Pumping Engines do. 108 do. These perform the work of pumping only, two of which pump water from Mine and 17 for washing purposes direct.  
4 Locomotive Engines do. 24 do.  
114 Engines equalling 1,238 do. In addition to these Engines, there is 1 Shop and Sawing Engine of 25-horse power and 1 Steam Navy.  
Also 1 10-Horse power Hauling Engine now being erected, and 1 22-Horse power Boiler since erected and begun work.

IN BULTFONTEIN MINE THERE ARE

29 Hauling Engines equal to 378 Horse Power.  
31 Washing Engines do. 279 do. Of these 19 of the Boilers perform the double work of Washing Ground and Pumping Water.  
12 Pumping Engines do. 63 do. These perform the work of pumping only for washing purposes direct.  
3 Locomotive Engines do. 26 do.  
75 Engines equalling 746 do. In addition to these Engines, there are 2 12-Horse power Locomotive Engines being erected.

Compiled by J. W. W. POTTS.

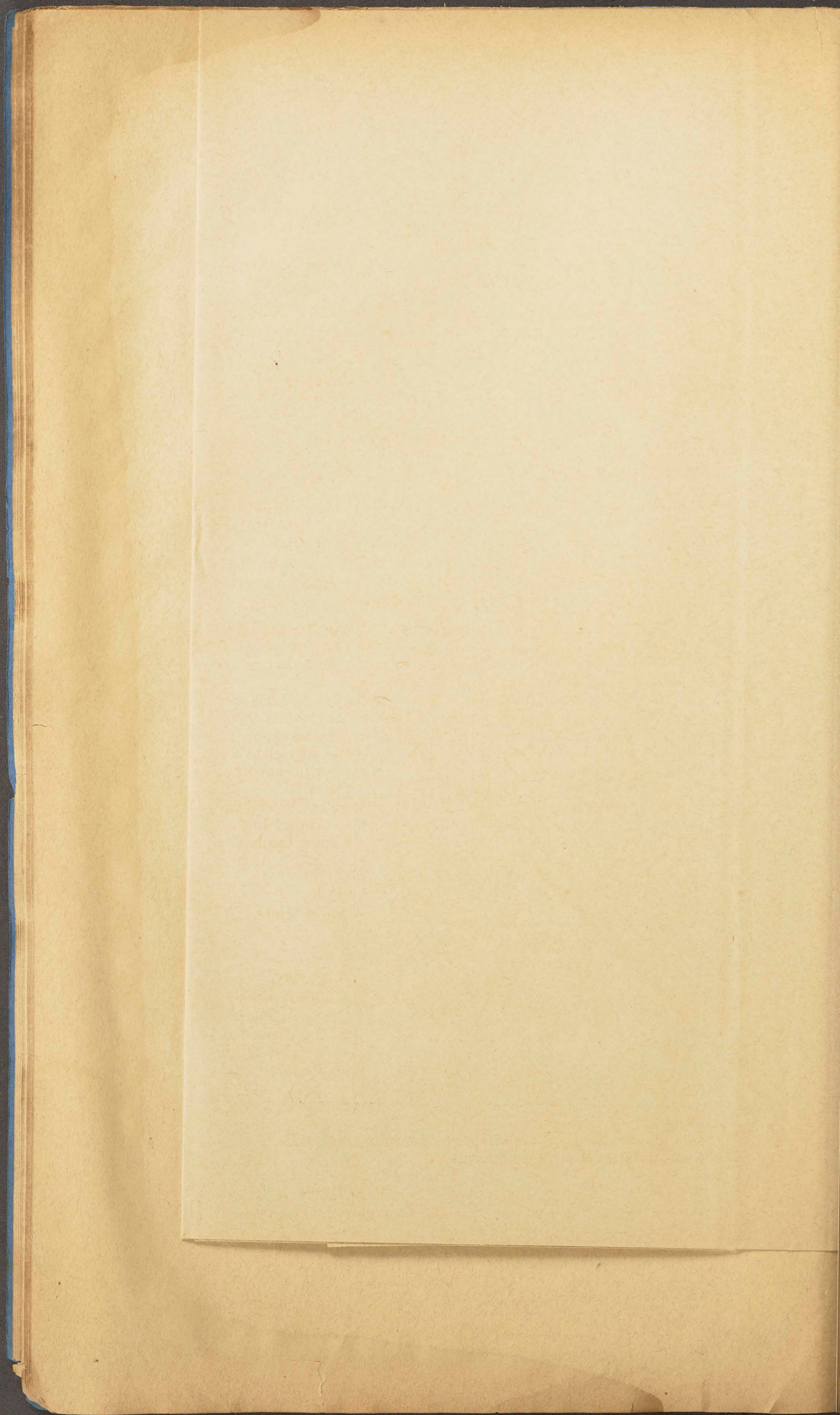
Ratio of Ground hauled and labour employed daily per Acre.

DUTOITSPAN.				BULTFONTEIN.	
Ground hauled Cubic Feet per Acre	..	..	7,813	6,890	
Mechanics employed	do.	..	3.3	4	
Overseers	do.	..	10.16	7.31	
Natives	do.	..	104.3	122	
Hauling Engines employed	do.	..	1.58	1.31	
Horse-power hauling	do.	..	21.3	17.8	
Claims being worked	do.	..	34	26.02	
General Excavation Cubic Yards Solid	..	..	109,724	203,280	

H. J. YONGE, Surveyor of Mines,

DUTOITSPAN AND BULTFONTEIN,







REPORT  
ON THE  
MACHINERY EMPLOYED  
IN THE  
DIAMOND MINING INDUSTRY  
OF GRIQUALAND WEST,  
BY THE INSPECTOR OF MACHINERY.

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*The Inspector of Mines, Kimberley, to the Commissioner's Office.*

No. 42/83 A.]

Chief Inspector of Mines Office, Kimberley,  
16th February, 1883.

The Assistant Commissioner of Crown Lands, Cape Town.

SIR,—I have the honour of forwarding by post this day, for the information of the Honourable the Commissioner of Crown Lands, the General Report by Mr. Schute, the Inspector of Machinery, on the machinery in use at the Diamond Mines and Diggings in Griqualand West.

The appointment of a qualified Inspector of Machinery has had not only a most beneficial effect already, but the Diamond Mining Companies themselves, certainly as regards Kimberley and De Beer's Mines, besides approving of the appointment in the interest of safety, appear to quite appreciate the benefit accruing to themselves from an economical point of view in having a fully-qualified official to consult in technical matters.

I respectfully trust that after perusal of this Report on machinery, the Commissioner may be of opinion that the appointment of a technical Inspector of Machinery, in kind compliance with my recommendation, has been a most advisable one.

I have, &c.,  
(Signed) W. C. C. ERSKINE,  
Inspector of Mines.

*Mr. F. Schute to the Chief Inspector of Mines, Kimberley.*

No. 29/83 C.]

Chief Inspector of Mines Office, Kimberley,  
15th February, 1883.

The Inspector of Mines, Kimberley.

SIR,—I have the honour to enclose my Report on the Machinery employed in the Diamond Mining industry of Griqualand West, with the request that you may duly forward it to the office of the Honourable the Commissioner of Crown Lands and Public Works.

The scope of my inspections for the purpose of this Report was indicated by letters from the office of the Commissioner No. 12/327 of June 2nd, and No. 1,929 of June 23rd, 1882, during which month, I may state, I commenced the actual duties of my appointment.

I have, &c.,  
(Signed) F. SCHUTE,  
Inspector of Machinery.



## CONTENTS OF THE REPORT.

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- Chapter I.—General description of Machinery used in Diamond Mining operations in Griqualand West.
- Chapter II.—Types of Engines and Boilers generally in use.
- Chapter III.—Defects found in existing machinery.
- Chapter IV.—Special difficulties to steam users at the Diamond-fields.
- Chapter V.—Where danger is apprehended, and for the prevention of accident.
- Chapter VI.—Proposed regulations to be observed by firms using steam boilers, engines, &c.
- Chapter VII.—Using existing gears for transporting Native labourers from and into the Mine.
- Chapter VIII.—Qualifications of Engine Drivers, &c.
- Chapter IX.—Uneconomical features of the aerial hauling system.
- Chapter X.—Inspection and Registration by steam-users of Machinery and Boilers.
- Chapter XI.—Average description of a Mining Company's Plant, list of Machinery at the principal Mines, &c., &c.
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### CHAPTER I.

#### GENERAL DESCRIPTION OF MACHINERY USED IN DIAMOND MINING OPERATIONS IN GRIQUALAND WEST.

Machinery is used more or less at Diamond Mines and Diggings throughout the Province of Griqualand West, that is, in all the three divisions to which independent Inspectors of Mines are appointed; it is only, however, in the mines proper, which are included in the two districts of Kimberley and Du Toit's Pan, that the different processes peculiar to winning diamonds are entirely dependent on machinery driven by steam power.

At the river- and also the dry-diggings in the district of Barkly, the operations of dealing with diamondiferous soil are necessarily carried on only on a very limited scale in comparison with the work done in the big mines, and any mechanical appliances used are generally worked by manual labour.

The three districts above alluded to are controlled by the following Inspectors:—

1. The Inspector of Mines at Kimberley, who supervises all mines and diggings on the Vooruitzicht Estate, including the Kimberley and De Beer's Mines, &c.
2. The Inspector of Mines at Du Toit's Pan, who includes the Du Toit's Pan and Bultfontein Mines in his district.
3. The Inspector of Claims at Barkly, who controls the alluvial and dry diggings situated on or near (in a northerly direction to) the River Vaal; the principal stations being Delpoort, Waldek's Plant, Gong Gong, Newlands, Hebron, &c.

In the two first divisions where diamonds are generally sought for only in regular mines, the process of profitably working diamondiferous ground has called into requisition machinery driven by steam power; firstly, for hauling the ground from the mine, then in some instances for transporting it



by means of locomotives to the depositing floors (where the "blue" ground is left for a considerable period to weather and becomes disintegrated) and finally, in winning the diamonds from this pulverized soil by the aid of rotary washing machines, pulsators, &c., which in all cases are driven by engine power.

The general disposition of the various mechanical appliances used at the mines in the Kimberley and Du Toit's Pan districts is as follows:—Within the mines themselves (1) the wire-rope roadways stretched from the surface of the mine to their anchorings at the working levels of the claims below; (2), the tramways at the bottom of the mine; and (3), a few pumping-engines constitute the machinery, but at the surface of the mines and disposed generally all the way round with varying distances of from, say, 100 feet to 500 feet from the edge of the mine, are situated the mass of hauling engines and their gears, &c. From here the depositing floors reach right away in some cases to distances over two miles from the mine.

The sites of the washing engines, as also of the steam pumping-engines, which latter are required for watering purposes on the depositing floors, for feeding the boilers and supplying the large quantities of water used by the washing machines, are generally fixed in the far boundaries of these depositing areas. Tramways traverse these floors in all directions, and locomotive power, used instead of horses, mules or oxen for dragging the vast number of truck loads of blue ground or reef from the mine to their respective tipping places is gradually extending with beneficial results.

For purposes of reference and to avoid unnecessary repetition, I may add that a description in detail of the methods of working, as also the different processes the diamondiferous ground won in the mines passes through by the systems that obtain at present on the Diamond-fields, is generally described by the Inspector of Mines on the "Vooruitzicht Estate" in his Report published in a Blue-Book of 1882 (G. 27—'82).

The machinery in general use, then, in diamond mining operations may be tabulated as follows:—

1. *Hauling Gears*, which are on the following three different systems :
  - (a). Winding engines, pulling cages containing trucks filled with ground, up vertical shafts.
  - (b). Winding engines, pulling loaded trucks up inclined tramways.
  - (c). Winding engines, pulling (1) "tub-carriages" or (2) "sling carriages" containing a loaded truck, up inclined aerial rope-ways.

These gears include the use of steam-engines, boilers, and wire ropes for the following distinctly different purposes, *i.e.*, guide ropes (in shafts) "standing wires" (in aerial gears), and "hauling wires" (in every system), together with all the paraphernalia required in making stout connections of the standing wires to moorings on the surface of the mine and firm anchorings for these wires at the bottom of the mine, with all the intermediate supporting standards to maintain the rope-way gauge and keep the standing wires in position.

2. *Washing Gears*, including engines, boilers, elevators, pulsators, rotary puddling machines, &c., &c. (described in Report already referred to in Blue-Book, G. 27—'82).

3. *Pumping Gears* and miscellaneous stationary engines, boilers, &c., of various types.

4. Locomotive engines and permanent way.

At the diggings in the division of Barkly, where diamonds are sought for, the mechanical appliances, generally speaking, are very primitive, it being only at some of the larger alluvial diggings that engines or steam-pumps are used.

At the deepest alluvial diggings, such as Waldek's Plant and Gong Gong, which are situated a short distance away from the present bed of the Vaal River, shafts of various depths up to about 93 feet from the surface have been sunk, from which the soil and stones are hauled up in small buckets by means of a hand-worked crab or windlass. The diamondiferous ground is



sorted from the valueless stuff down in the shaft, and on being brought to the surface is generally treated there and then in a cradling machine called—after the originators—the “Rule and Henry” machine.

This machine consists in the main of a hopper fixed over a washing water-tank, fitted into which are some three or four loose sieves having different sized meshes and to which a quick, vertical, reciprocating motion is given which causes the separation of the mud from the gravel. The contents of the sieves—which, of course, should retain everything except the fine mud—are emptied first in a heap on the ground and then on to the high end of a “baby” which in itself is a long table-sieve slightly tilted at one end and hung at its corners by links to a frame. A rocking motion gives the gravel a forward and spreading motion, and if there are any diamonds present they are quickly seen and picked out.

At the shallower diggings in the Vaal River, such as Delport, the diamond yielding ground is won from between the boulders in the bed of the river; it is then washed in a cradle, worked by hand, on a convenient spot slightly elevated above the level of the water, and screened in a sieve in a tub of water, and any diamonds present are easily sorted from this sieved stuff.

In none of these latter machines are there elements of danger to life or limb; to workers in the deep shafts, however, the danger is appreciable. It consists in any negligence that might exist on the part of the surface men (generally Kafirs) in lowering or raising these miners down to or from their work, or by the breakage of a hauling rope, or in the case of ground or boulders falling on to these miners when working at the bottom of the shaft.

I have compiled the following table showing the actual amounts of machinery of the different classes, either working or fixed, ready for immediate use at the four principal diamond mines in Griqualand West; but in the present depressed condition of the mining industry it is not surprising to find that about 38 per cent. of the gears are in temporary disuse.



TABLE No. 1.—RETURN OF MACHINERY IN POSITION AT THE KIMBERLEY, DE BEER'S, DU TOIT'S PAN,  
AND BULTFONTEIN MINES.

Date.—December 1882.	Number of Hauling Gears driven by Engines.	Number of Washing Gears driven by Engines.	Number of Pumping and other Engines.	Total number of Engines in each Mine.
Kimberley Mine ... ..	48	27	21	96
De Beer's Mine ... ..	36	20	19	65
Du Toit's Pan Mine ... ..	49	42	42	133
Bultfontein Mine ... ..	29	30	23	82
Total number of Engines at the four Mines ... ..	...	...	...	376

These 376 (three hundred and seventy-six) steam engines represent a grand total of 4,034 (four thousand and thirty-four) nominal horse power for the four principal mines of Griqualand West, and besides these engines there are thirteen horse-whims still in actual use for hauling purposes.



I am unable to give a complete list of machinery used in the diggings in the Barkly district, and at the smaller mines in Griqualand West, but their combined total is relatively a very small amount in comparison with the figures quoted in the preceding table.

## CHAPTER II.

### TYPES OF ENGINES AND BOILERS GENERALLY IN USE.

I. The general type of engine and boiler used in the mining industry of Griqualand West, both for hauling and washing purposes, is that known as the semi-portable engine with multitubular locomotive boiler combined, but in a large number of cases the engine is separate from the boiler and on a distinct foundation, but with similar boiler as above, and this latter arrangement possesses some apparent advantages.

The locomotive type of boiler undoubtedly in most particulars suits the requirements of the Diamond Fields admirably; it is economical as regards its steaming qualities, and it is well adapted for using such varieties of fuel as exist here, viz.:—Wood, coal, and cow-dung.

Its portability, too, specially recommends its adoption in these outlandish districts where rates for transport are so exceptionally high, equalling and surpassing in many instances the actual cost of goods as delivered at the ports of the Colony, and I assert that with the least ordinary care such a boiler combines safety with efficiency superior to that of any other class of boiler.

A disadvantage, however, in this type of boiler, especially conspicuous in this district, is the difficulty to cope with the limy deposit which the only water available for use here is so highly charged with, and which attaches itself so readily to such vital parts as the fire-box and tubes of the boiler. The neglect on the part of boiler attendants to systematically clean out this deposit, which is often suffered to collect in most dangerously large quantities, proves the patience of this type of boiler in withstanding such lamentable abuse.

Sometimes, however, the blame may clearly be traced to the omission on the part of the manufacturers at home to provide ready means of inward view or access to these important parts of the boiler.

The hauling engines are, with very few exceptions, double cylinder, are geared with a single winding-drum and fitted with link-motion reversing gear.

Their size varies generally between 8 nominal horse-power and 25 nominal horse-power, and they are generally adapted for a working pressure of from 60 lb. to 90 lb. on the square inch.

There are a few compound engines on the Fields, usually of 16 to 25 nominal horse-power, but these do not appear to be in general favour with Managers of Companies, owing, no doubt, in an extent to a difficulty that exists to obtain engine-drivers sufficiently intelligent to attend also to any necessary repairs, setting of valves, &c., that may be required in this less known and, perhaps, more complicated style of engine.

The other types of engines I have found here are the ordinary horizontal fixed engine (condensing and otherwise) up to 20 nominal horse-power, and at the Kimberley Mine the French Diamond Mining Company have recently erected a 75 nominal horse-power direct-acting winding engine of the Corliss type, for pulling ground in loaded trucks in cages up their vertical shaft from a depth of about 300 feet.

Three detached multitubular boilers working at a pressure of 70 lbs. supply the engine with steam. The whole gear is of French make, and not in accordance in some details with the best English practice.

2. The washing engines are, as a rule, the ordinary single cylinder semi-portable engines and multitubular boiler combined, including all the usual



types of this class, and vary generally between 6 nominal horse power and 20 nominal horse power.

The boilers are usually adapted for a pressure of 60 lb. on the square inch, but more frequently than not, when the boiler is kept in an efficient state as regards cleanliness, not much more than half that pressure is found equal to the work required from it for actually driving the rotary washing machines, elevators, &c.; in other words the available power is frequently in excess of the work it has been set to perform, and in many cases additional work has been added in the driving of geared pumps, pulsators, circular saws (for cutting up fire-wood), or the driving lathes and other tools in the workshop where repairs to the machinery of the Company are effected.

3. The majority of the engines specially used for pumping water from the "pans" or "vleys" for the various purposes of watering the blue ground on the floors or feeding boilers, as also the machines used in washing operations, are generally only of small power, varying from 4 nominal horse-power to 8 nominal horse-power. A usual type is a vertical multitubular or a cross-tubed boiler with engines fixed on the same bed-plate, and driving by means of a wire rope a double-action pump mounted on a bed-plate and fitted with a crank shaft, &c., fixed in a suitable position to draw the water.

Besides these engines there are a number of direct-acting steam pumps used in all the mines, varying in sizes up to 16" diameter of steam cylinders, with an 8" diameter of water cylinder, and capable of pumping up to about 12,000 gallons per hour.

4. Locomotive engines are used by six firms in the four mines under notice, and probably it is only the extravagant cost of fuel that prevents their more general adoption in lieu of horses, mules, &c.

These locomotives, for transporting "blue" ground from the tipping boxes to the floors, are of small size to suit tramways of 18 inches, 2 feet 3 inches and 2 feet 6 inches gauges, but they haul three or four times as many trucks as are usually pulled by a horse, and taking into consideration the gradually-extending distances of the floors from the mines (up to over 2 miles in certain cases) it cannot be doubted that the saving even at present must be considerable.

Nine locomotives are used in this service (all at the Du Toit's Pan and Bultfontein Mines), and they are in every case of recent design and well adapted for their work. The tramway rails are always of steel, weighing from 10 lb. to 18 lb. per yard, and are variously carried on wood or iron sleepers.

At the Kimberley Mine the Mining Board possesses four larger locomotives (which can hardly be described as types of the best modern practice) for a 3 feet 6 inches gauge, and which are leased to the contractor for his operations in running reef from the eastern side of the mine to the tipping place—about one mile distant.

The mileage of tramways laid at the four mines under discussion is shown in the following tabular statement:—



TABLE No. 2.

MINE.	NUMBER OF FIRMS USING TRAMWAYS.		APPROXIMATE MILEAGE OF SINGLE LINE.	
	For horse or mule traffic.	For locomotives.	18in. gauge.	Other gauge
Kimberley... ..	11	1	12	1½
De Beer's ... ..	16	—	11½	—
Du Toit's Pan ... ..	28	2	64	4
Bultfontein ... ..	9	3	34	7
Totals ... ..	64	6	121½	12½
Combined total length of single line of tramways at the four mines ... ..			134 miles.	

The expense of laying tram lines here varies very much, on account of the fluctuating price of material, diverging, in the case of rails, from £28 to £55 per ton, bought in Kimberley; but the average price of laying a single line tramway 18 inches gauge and 12 lb. rails on fairly level ground (with ballasting) and timber sleepers, inclusive of points and crossings, may be taken at from 15 shillings to 20 shillings per yard. A detailed statement of the various items is as follows:—

COMPARATIVE COST OF CONSTRUCTION AND MATERIALS  
FOR 18IN. GAUGE TRAMWAY OF 12LB. RAILS, AS IN  
GENERAL USE AT THE DIAMOND FIELDS AT THE  
FOLLOWING DATES:

	1881 JUNE—SEPTEMBER.	1882 OCTOBER—DECEMBER.
Formation ... ..	2s. 6d. per yard	2s. per yard
Plate laying—double line ...	2s. „ „	1s. 6d. „ „
Cost of rails—12 lb. to the yard...	50s. per 100 lb.	26s. per 100 lb.
Wood sleepers, 3ft. x 4½in. x 3in....	4s. 6d. each	2s. 3d. each
Iron sleepers with clutch bolts ...	5s. 6d. „	4s. 3d. „
Iron sleepers with Elm keys ...	7s. 6d. „	5s. 6d. „
Dog spikes 6½ to the lb. ... ..	1s. per lb.	9d. per lb.
Fish plates, 1 to the lb. ... ..	1s. „ „	8d. „ „
Fish plate bolts, 10 to the lb. ...	1s. 6d. „ „	10d. „ „
Single points and crossings ...	£12 10 0	£9 0 0
3 way points and crossings ...	£25 0 0	£18 0 0
♦ Diamond points and crossings...	£70 0 0	£53 0 0
“Hudson's” 16ft. steel trucks...	£22 0 0	£16 0 0



## CHAPTER III.

## DEFECTS FOUND IN EXISTING MACHINERY.

The first steam engine for hauling purposes is said to have been started on the Fields in the year 1873, but a general introduction of steam power to help in the various processes of extracting diamonds from their bed, dates back to only about 1878, and as all the engines with their boilers engaged in pumping, hauling or washing were brought to the Fields new, it might fairly be expected that at the present time even the oldest boilers should be in fairly good condition, and capable of living through a few more years of constant work, as these would be at most only 4 or 5 years old.

Such a state of affairs, however, is, I consider, very far from existing, and many boilers not more than 2 or 3 years in work are giving trouble in their unmistakable signs of failure. This has undoubtedly been brought about by ill usage, and most generally the inattention to clean out systematically the deposit and incrustations forming inwardly by reason of the dirty or impure water used for feeding. Most watchful surveillance of these boilers becomes, I consider, more necessary each succeeding day, as they are naturally continually deteriorating in efficiency and safety, and the chance of explosion, the certain goal of careless inattention, should be put beyond the margin of possibility.

Summarized herewith, however, are the special defects that I have discovered in my inspections of engines, boilers, and gears, &c., in the different mines of Griqualand West. I then discuss each kind of defect in detail or append particulars of illustrative cases from my notes taken on the spot, some of which undoubtedly suggest the necessity for promulgation of some regulations for safer working.

In every case where I have apprehended danger, I have immediately issued a "Notice for Safety" to the accredited agent of the company, describing the fault, and ordering the immediate repair of the defective part, or, failing that, the stoppage of the part of machinery or boiler I considered dangerous; and it is to be presumed that many accidents have thus been prevented.

In certain cases I believe these notices have answered a further purpose in cautioning owners or lessees of machinery of dangers run, and so acting for future instruction in a direction of more careful and safer working.

In the following table the figures attached show the number of the "Notices for Safety" I have issued thus from June to December, 1882. I have ordered 179 renewals, additions, or repairs, to defective parts of machinery.

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DEFECTS FOUND IN MACHINERY, &c.		No. of cases.
Engines, Gears, &c.	1. Want of guards to moving parts of machinery	... 28
	2. Insufficient brake-power to hauling engine	... 26
	3. Miscellaneous parts of engines, &c., out of order	... 6
	4. Defective hauling and standing wires	... 45
	5. Standards or jumpers unsteadily fixed	... 2
	6. Faulty attachments of hauling and standing wires	... 10
Boilers.	7. Fracture and corrosion, &c., of plates	... 8
	8. Damage owing to accumulation of deposit or deficiency of water	... 13



## MOUNTINGS FOUND IN BAD CONDITION.

Boilers.	9. Fusible plugs in fire-box out of order	...	...	2
	10. Glass water-gauges and test cocks out of order	...	...	10
	11. Steam pressure guages unreliable	...	...	9
	12. Safety valves overweighted or otherwise out of order	...	...	7
	13. Insufficiency of the number of mountings on boilers	...	...	9
	14. Inadequate means afforded by manufacturers for examining the interiors of boilers	...	...	4
Total				179

To this list I should add the defects or omissions in construction which cause difficulties of examination, and in this category I must put the majority of jumpers or standards, at or near which points the standing wires have a tendency to fail.

A few steps or a ladder arrangement at the highest standards should be affixed to every such support, as in many cases it would require an Inspector to be little short of a fair gymnast to examine the standing wires at their bearings on these erections.

## WANT OF GUARDS TO MOVING PARTS OF MACHINERY.

Not only for the safety of the driver and attendants about machinery, but also for those persons whose duties call for their occasional presence in engine houses, I consider handrail guards or fencing of some sort or other at the side of revolving or quickly moving parts of mechanism as most essential, and I have ordered the immediate erection of many such protecting guards in the engine houses under my recent inspection.

I have found geared wheels in prominent places perfectly unfenced, and quite apart from the consideration of ordinary safety for European engine attendance, I am inclined to think that the ignorance or recklessness of Kafirs (who often attend to the lubricating, &c., of the machinery) requires additional protecting safeguards, as illustrated by the following case.

*Case 1.*

A Kafir, acting as assistant to the engine driver, in lubricating the engine actually stepped over the gearing driving the winding drum whilst in motion, in order to save himself a few steps of walking round the engine; his leg was caught in the revolving wheels, and he died the following day from the effects of his recklessness.

*Insufficient brake-power to Hauling Engines.*

The large majority of the cases where I have ordered by "Notices for Safety" additional brake-power to be added to hauling engines, have been where the winding drum, which is geared to the engine, has had no other control over it than the brake on the fly-wheel of the engine. Should anything in such cases go wrong with the crank shaft, &c., of the engine or the gearing itself, the engine driver would lose all possible control over what the engine is hauling, viz., either the cage with its contents in the case of vertical shafts, or in the case of the wire rope aerial inclines, the loaded tub-carriages, and this of course to the imminent danger of workers below.

I consider it necessary that a reserve of brake-power should always be kept in hand for the protection of workers in the mine, in the neighbourhood of standing wires, for use in any unforeseen emergency.

Two cases of crank shafts having broken at critical moments, and one case of the pinion-wheel having had its teeth stripped, have come to my notice, and providentially no fatal accident, I believe, took place; but I mention



these incidents as pointing to the absolute necessity of the engine drivers having adequate brake-power over the winding drum, as the danger of "run away" tub carriages is apparent.

#### FRACTURE AND CORROSION, &c., OF PLATES.

The cases of fracture or distortion of plates in boilers that as yet have come to my notice in the sphere of my inspections, have all occurred in the fire-boxes, and in each case I have traced the origin of the defect to a deficiency of water in the boiler when in work, the fault either of the man in charge, viz., his carelessness in allowing the water during work to run too low by forgetting to put on the "feed," or the fault of the stoker (generally a Kafir) who in his gross ignorance in firing up in the morning, has no notion of the value or wherefore of the glass water-gauge. I must add that an inordinate accumulation of deposit on the crown plates and tube plates of the fire-box has not improbably considerably helped to these unsatisfactory results.

In this district, as a rule, every boiler-house with its engine is in charge of a white man, whose duties generally consist in driving the engine and superintending the stoking of the boiler, which is actually performed by a Kafir.

The former each evening sees to the boiler being filled with water, and ready for the following morning's firing up, when the Kafir lights the fire, and generally under no superintendence.

Should the boiler lose its water during the night by leakage of the cocks or by one of these having been left open by misadventure or mischief, it is unlikely that this Kafir would attach any importance to the fact even if it came to his notice at all.

However, considerable permanent damage to the fire-box plates and tubes would certainly be the result, even if the boiler did not explode before the white man arrived and saw the state of affairs, but I suggest for better safety that managers of companies should be instructed that responsible men must be present at the firing up of boilers every morning to see to everything being in order. Except by a special "alarm" mounting it is impossible to guard against such gross carelessness on the part of drivers as allowing the water to get too low in the boiler, a majority of which, here, are probably fitted with both feed-pump and injector, and in several cases also with an additional "stand-by" donkey pump.

However, I suggest for extra conspicuousness that a distinct metal pointer should be attached to (or a white line should be painted across) the front plate of the fire-box, showing the identical height of the crown of the fire-box in reference to the glass water-gauge, which would, I think, act as a good "reminder" to the attendant.

In this place I may refer to the disinclination I have found to obtain here on the part of many boiler attendants to use the injector, on the fallacious argument *that it feeds the boiler with cold water whilst the ordinary pump supplies water heated by the exhaust steam*, this mistaken notion probably arising from the fact that the injectors are not adapted for drawing warm feed water from the cistern (heated by the exhaust).

On different grounds my opinion is that in most cases injectors should be used in preference to the feed pump, and I should be glad to see their more general use.

#### DAMAGE OWING TO ACCUMULATION OF DEPOSIT.

The feed water used in this district for boilers I have always found more or less impregnated with large quantities of lime, and on examining the interior of the boilers, have met with all the usual formations of deposit, *i.e.*, sometimes thick hard scale, sometimes a soft or crumbling powder, and in a few cases the more dangerous deposit of a thick greasy nature, which, when



it coats the fire-box tubes with a certain thickness, effectually prevents the heat passing through, and so the furnace-plates get burnt or cracked, to the imminent danger of the safety of the boiler.

Instead of soda or patent boiler dis-incrustants, which are sometimes used here to help in disengaging this limy deposit from the plates of the boiler, I should much prefer the frequent "blowing off" of a certain quantity of water at stated intervals, and thus going to the root of the evil, combined, of course, with thorough, systematic, periodical, inward cleansing (under hose pipe pressure), and thus never allowing above a trivial amount of deposit collecting.

To effect this, all manhole covers, mud plugs, &c., should be removed at least once every fortnight (equal to a run of about 130 to 140 working hours), and say three or four inches of water to be blown off under steam during the midday interval.

#### ACCUMULATION OF DEPOSIT.

##### Case 2.

##### *16-Horse-Power Semi-portable Hauling Engine with Multitubular Boiler (Locomotive style).*

The tube plate of fire-box was fractured in three different places, the cracks extending in each case from hole to hole.

Thickness of plate	...	...	...	...	$\frac{5}{8}$ inch.
Inside diameter of tubes	...	...	...	...	$2\frac{1}{4}$ "
Pitch of tube about	...	...	...	...	$3\frac{3}{4}$ "

Leaving metal in the narrowest place about  $1\frac{1}{8}$  inches broad, quite a maximum strength in this part of this class of boiler.

The damage to this plate occurred by overheating, due to accumulation of deposit in the form of thick, limy mud in the boiler, and especially (as always) where the tubes leave the fire-box—on cleansing the boilers, the spaces between the tubes were found entirely choked up with deposit for a distance of some inches from the plate. The boiler was set to work again after renewing the plate (at a cost of over £150), entailing during repairs a delay of very valuable time.

Systematic periodical cleanings would of course have prevented this damage.

##### Case 3.

##### *25-Horse-power Hauling Engine—Locomotive Type of Boiler.*

The crown plate of fire-box was cracked for a length of about four inches, the tube plate also was leaking at four or five tube connections which "ferruling" would not stop. This boiler had been working night and day for over twelve months, during which time the owners could not "afford time" (*sic*) to stop for a thorough cleansing and overhauling—and if the truth were known probably very seldom (if ever) "blew off" under steam to get rid occasionally of a certain quantity of the dirty water. I found a very hard tenacious limy scale of  $\frac{1}{2}$  inch thickness on this crown plate, the spaces between the bridge-stays and this plate entirely corroded up, and the tube plate also dangerously covered with thick incrustation. Comment is needless.

#### DEFICIENCY OF WATER.

##### Case 4.

##### *10-Horse-power Semi-portable Boiler (Locomotive Type).*

The crown plate of fire-box was bulged down very severely in all the middle spaces between the stay bolts, due to a deficiency of water in the boiler during work.



Had this plate not been of superior quality (probably Yorkshire iron, though I could not distinguish a brand), a disastrous result might very probably have occurred by this gross carelessness of the person in charge, in not glancing now and again at the recorded height of water in the glass water gauge.

I ordered a reduction in the working pressure of the boiler, necessary owing to the weakened condition of this plate.

*Case 5.*

*Semi-portable Washing Engine combined with Boiler of Locomotive type.*

A man with no qualifications whatever as to a capacity to attend to a boiler, was engaged as engine driver by his brother—the manager of the company—and he had only been in charge of the gear one day, when he had the crown plate of the fire-box burnt and damaged beyond possible satisfactory repair, owing to his allowing (in his gross ignorance it must be said) the water in the boiler to get too low.

The gauge certainly showed water to a height of a couple of inches above the top of the fire-box, but in this attendant's complete ignorance, he had got the bottom cock of the glass gauge closed, and therefore this mounting was of no practical use, but on the contrary most misleading.

The crown plate seemed to have been red hot, but enquiry as to *why* serious damage to property did not result could not be fairly answered.

FUSIBLE PLUGS OUT OF ORDER.

Although I do not put too much faith in the efficacy of the majority of the makes of these safety mountings, having known many cases of failure to act at the critical moment, still, with a good type of fusible plug, and its being kept clean from deposit, its presence is an undoubted help towards safety in the ordinary working of a boiler, and I should enforce its general adoption—especially as it does not form a source of weakness to the boiler.

GLASS WATER-GAUGES AND TEST COCKS.

Some gauges and test cocks I have found in a perfectly useless condition from their passages being choked up with limy deposit—others in numerous instances with their handles broken off or plugs jammed in too tight to allow of their being turned, except by loosening the screw or with a long spanner (generally not attainable when I have enquired for it), and actually in some cases having their handles tied up with wire to prevent their being used—the excuses offered for the latter state of affairs being always most puerile.

As “damage to furnace-plates or fire-boxes” might generally be taken as a synonymous term with the above condition of things, it will be at once allowed how necessary for safety it is to keep these mountings in proper working order. I have been surprised to find in boilers of quite modern manufacture on the Diamond Fields, that, in certain cases the bottom glass water-gauge cocks have been fixed so low that water would still be visible in the glass to the height of 2 inches when the fire-box crowns were dry—an error on the part of makers of boilers that with an imprudent or inattentive stoker (who would not think it part of his duty to satisfy himself practically as to the relative heights of this glass water-gauge cock and the crown plate), might easily lead to most disastrous damage to the boiler as well as danger to persons' lives.

I suggest, therefore, that, for better safety, either (as previously argued) the height of the fire-box crown should be distinctly marked by a painted line on the front side of the fire-box contiguous to the glass water-gauge cocks, or in lieu thereof the limit of the lowest water-level of every boiler should be designated by a conspicuous pointer placed immediately behind the glass tube.



## STEAM PRESSURE GAUGE.

In the case of two boilers on the Fields I have discovered the enamel together with all the figures on the dial plate of the only Pressure Gauge attached to these boilers, entirely obliterated, and the attendants perfectly happy and reckless as to whatever undue pressure might be attained in the boiler. I have also found a large number of defective gauges indicating from 10 lb. to 30 lb. less than the pressure in the boiler, either as calculated by me where lever safety valves were attached, or as recorded on the single, or sometimes double salter spring balances on the same boiler.

I attach some importance to receiving the pressure gauge testing apparatus which is ordered for my use from England, as a ready means for testing the accuracy of the many pressure gauges I have firm doubts about, and, as in many cases, the load on the safety valves are adjusted by this gauge, I cannot impress too strongly the necessity for the avoidance of extraordinary risk by requiring this mounting to be in a state of perfect efficiency.

I urge in this place the desirability of requiring *new* boilers at any rate, all to be provided, compulsorily, with a suitable branch or nozzle to which a standard pressure gauge of a Government Inspector of Machinery could be easily temporarily fixed for the purposes of comparison; also that a conspicuous mark on the dial of the pressure gauge should be compulsory for the future to shew the limit of the originally allowed working pressure of the boiler.

*Case C.*

*Semi-portable Boiler (Locomotive Type) used for Pumping Engine,  
8 nominal horse-power.*

The figures on the dial plate of the only steam pressure gauge on this boiler were entirely obliterated, the glass, together with all marks, having cracked off the metal back.

A white boy, 17 years of age, was in charge, and, besides, naturally, being perfectly unaware of the pressure he worked the boilers at, seemed equally ignorant of the extraordinary danger his employer was placing himself and others in, by not attending to the efficiency of this comparatively uncostly, but most necessary mounting. At this same boiler the glass water gauge, and lower test cock also, were in perfectly useless condition—in the former there was no glass, the top cock of the glass water gauge was completely choked up with limy deposit, and the bottom cock was broken in the body. The lower test cock had the handle of the plug broken clean away.

This chapter of defects in the mountings on a single boiler is, perhaps, the worst I have met with in the Fields.

## SAFETY VALVES.

I have discovered safety valve levers on several occasions dangerously overweighted with iron pick heads, or large stones (attached to the lever by wires), and to such an extent, that the boilers would certainly have given way or exploded, before any steam could find its way out of the valves, as in each case the overloaded safety-valve was the only means of easing any improper pressure of steam in the boilers.

I am distinctly of the opinion that for efficient safety all locomotive type boilers—and, as already stated, the vast majority of the boilers used in the diamond mining industry are of this class—should be provided with at least *two* safety valves, and preferably one of which should be a “direct loaded lock-up” valve, and so unable to be tampered with.

I have found one case of such a valve out of order in the course of my inspection in this district, but with the great improvements effected in the last few years in the manufacture of really reliable spring loaded valves, I myself very much favour their adoption; and I may mention the fact that



the Board of Trade of the Imperial Government, has, for sometime, sanctioned their use, and in Government work they are extensively adopted.

In regard to the salter spring safety-valves the vast majority of those on the boilers under my inspection have not been provided with the simple safeguard of slipping a ferrule over the screwed spindle, to prevent any mischievous person from screwing down the valve to a pressure, sometimes quite beyond the capabilities of the boiler withstanding.

This state of affairs has been found in England before now to have led to explosions.

The insertion of this ferrule, as above, so that this valve must rise and let off steam at the fixed "blowing-off" pressure, effectually overcomes the freedom with which this class of safety-valve can otherwise be tampered with, and it seems curious that it has been so generally overlooked in this district.

#### INADEQUATE MEANS OF INSPECTING THE INTERIOR OF BOILERS.

Most of the boilers of the locomotive type used on the Fields, designed for an ordinary working pressure up to 80 lb. on the square inch, have generally an oval manhole on the shoulder over the fire-box of fairly adequate size, for observing the state inwardly of the bridge-stays, the crown plate of the fire-box and the tubes, &c. In contra-distinction to this, the majority of the boilers working at a considerably higher pressure (up to 125 lb.) and generally driving compound engines, are unprovided with any such means of inspection, and in several cases it is only through plug-holes or, perhaps, a safety valve seat (having a hole, say 4 in. in diameter) that any observations as to amount of corrosion, or formation of deposit going on in the boiler can be made.

I must distinctly urge that this is a state of affairs that should not be allowed to exist, especially having regard to the want of experience or knowledge in the prudent and safe working of boilers, that obtains in many boiler-houses on these Fields.

Every boiler (and especially high pressure boilers, perhaps) should, in my opinion, be, compulsorily, provided with at least one fairly large manhole to afford means, not only of viewing the interior of the boiler, but also to enable a man to remove with his hands, especially from the top of the fire-box and the tube ends at the tube-plate, such incrustation as resists displacement by the water jet from a pressure pump.

An objection that naturally might appear at first sight to the effect that such a mounting would weaken the boiler cannot, in my opinion, be seriously urged by any practical man, as, of course, the edge of the hole must be provided with a strengthening ring of suitable form and size to bear the strains of the steam pressure together with that coming on the cover (in screwing up the bridge bolts) in order to make a tight joint.

There is not the slightest practical difficulty in doing this, and I cannot but express a strong opinion that makers of boilers ignoring this mounting, show either a distinct want of judgment in the requirements of ordinary safety, or a wish to curtail expense of manufacture in a dangerous direction.

I have either recommended or caused manholes, suitably designed and strengthened, to be cut in several boiler shells, as referred to above, for a purpose, not only of safety in readily forming the means of inspecting the condition of the fire-box and tubes, but as a most material help in cleansing and removing accumulated mud and sediment from boilers of the type under discussion.

A thorough internal examination, of course, would involve taking out most of the tubes, but this is an expense that ought, in my opinion, to be faced in the interests of ordinary safety, at least once in two years, or say three years at most.



## DEFECTIVE HAULING AND STANDING WIRES.

The forty-five cases of defective wire ropes in actual use, which I condemned as unfit to continue in work from June to December, were about equally divided between hauling and standing wires, and in a large majority of the cases the faults were clearly inherent in the quality of the ropes, and not the result of wear.

Undoubtedly these ropes, and the standing wires in particular, are subject to exceptionally severe treatment, such as (1) the strain put on these standing wires by the anchoring in the mine shifting (by reason of the instability of the ground), or (2) by the wires being suddenly struck in blasting operations by large lumps of rock, or again (and especially where intermediate jumpers are required) by the jerky nature of the running of the tub carriages; but it is clear to me that the character and the duties required of standing wires are not sufficiently known or studied by the home manufacturers.

I have been informed of one or two cases of standing wires having stood constant work for 6 years, but I should estimate a fair life at three years, and, against this, I have had to condemn standing wires, as unsafe after only 2 or 3 months use.

The main qualities required for standing wires are, in my opinion, toughness and flexibility combined with uniformity of temper and power of tension, and they should be of such a hardness as to resist the wear that the tub carriage wheels—generally made of soft steel—otherwise would cause on their surface.

The standing wires are invariably made of steel, and vary in size from  $2\frac{1}{4}$  inches to  $5\frac{1}{4}$  inches in circumference.

The aerial hauling gears in position in the Kimberley, De Beer's, Du Toit's Pan, and Bulfontein Mines absorb an approximate total length of 68 miles of rope for standing wires.

These wires generally fail, as would be expected, at, or near the jumpers, and the first remedy for ropes showing broken wires in consecutive strands is to "long-splice" them in the defective part, turn the rope end for end, and thus bring an unworn portion to rest on the jumpers or other bearings.

The sliding the wire gets at these bearings by the varying position of the tub carriages on opposite sides of the jumper, is considerable, in fact I have known the outside wires of a rope to become half worn through in three months at these places, owing to the rope being too soft in quality.

Grease is not generally used for these ropes, indeed, on account of the dry climate, it hardly appears necessary to guard against corrosion, except underground at their attachments to the anchorings, but I am distinctly of the opinion that at all "sliding" bearings (viz.: at jumpers) a good lubricant (free from any acid) should invariably be used.

My remarks as to the inferior qualities of the ropes used as standing wires in this district, apply equally to *hauling wires*, which I have found very unequal indeed in their lasting powers, varying from 3 weeks, as a minimum, to 14 months of constant work.

All the hauling wires here are of steel, and almost uniformly of seven strands consisting of seven wires.

They vary in size from  $\frac{3}{8}$  inches to  $\frac{7}{8}$  inches in diameter, and for the 162 (one hundred and sixty-two) hauling gears at the four principal mines, the total length of wires in position runs to about thirty miles.

## INSUFFICIENCY OF THE NUMBER OF MOUNTINGS ON BOILERS.

Summarizing my previous remarks on the defects I have found in mountings on boilers, I suggest the following as a complete list of the mountings that should be affixed to the multitubular locomotive type of boiler, as a minimum, in my opinion. I discuss these mountings in further detail in some regulations I propose to be observed by steam users in this district, later in this Report.



## COMPLETE LIST OF THE MOUNTINGS NECESSARY.

1. Glass water-gauge with water level pointer.
2. Pair of test cocks.
3. Steam pressure gauge with syphon.
4. One manhole of ample size.
5. Set of mud plugs on shell of fire-box and in tube plate of smoke-box.
6. Blow-off cock.
7. Fusible plug in fire-box.
8. Injector.
9. Donkey pump with check feed valve attached to boiler.
10. Two safety valves.

## CHAPTER IV.

## SPECIAL DIFFICULTIES TO STEAM USERS AT THE DIAMOND FIELDS.

Having discussed the defects I have found in the machinery in making rounds of inspection at the various diamond mines and diggings, I will now enumerate special difficulties appearing to me to affect users of steam power and machinery in this province (so distant from all workshops of the world), as compared with the state of affairs in England,—which country I may note *en passant*, supplies, hardly without exception, all the machinery used here. Included among these difficulties are the following :

1. That very many of the engines and boilers in work here seem to have been sent out in a haphazard sort of way, *i.e.*, not built to any particular specifications, and either in many cases are of unsuitable design or sometimes incompletely provided with the necessary fittings and mountings sufficient for reasonable safe working.

Bad material too, especially in the case of wire ropes, has been sent from England to this market, in some cases it would appear simply to clear unsaleable stock at home. An important fault, or oversight, in the design of a majority of the boilers, here is that their fire boxes are intended for burning coal, whereas of all the boilers used at the four principal mines, only about 12 per cent. are fired exclusively with coal, as shewn in statement below.

In most instances, the boilers are identical in all details with those supplied to steam users at home, who of course use that class of fuel.

The area of the fire grate is not large enough for burning wood (and especially the inferior class in evaporative power that is usually brought to market here), thus a sufficient supply of steam can only be maintained in boilers in certain instances by cramming the fire-box with chocks of wood nearly up to the roof (detrimental in itself to the plates and tubes), and the amount of heat going to waste up the chimney is very great,—a lamentable state of affairs when the great and increasing cost of all kinds of fuel here is taken into account. The class of fuel used by companies at the four mines is as follows :

Boilers fired with wood only...	...	...	52 per cent.
“ “ coal “ ...	...	...	12 “
“ “ coal and wood mixed with other	}		36 “
“ “ kinds of fuel			
			<hr/> 100

Another prominent fault in the design of a certain maker's boilers, of which there are several examples here, is the arrangement of the tubes which are placed so close together (of course to gain heating surface) that I have found hard deposit form and entirely choke up the spaces between the tubes where they join the tube plate of the fire-box, in the short space of a few weeks' work.



In another part of this Report I dilate on the danger attending this state of affairs; and the trouble to keep the boilers fairly clean in this make of boiler, is largely enhanced by there generally being no manhole in any part of the shell.

The woods used for firing boilers are the Kameelhout and the Olivenhout, the former in great preponderance, but the latter is incomparably better wood for steaming purposes.

2. That the cost of machinery as it stands erected at the mines, also the cost of repairs, &c., may be roughly stated at probably treble the cost of such items in England, and to this must be added the inability to get certain repairs done in Kimberley, without waiting for material to be specially ordered for the job from England, thus for instance—putting a new tube plate into the fire-box of a boiler means a delay of some months, at least, after giving the order.

3. That a difficulty seems to exist in obtaining engine-drivers, or attendants able to take intelligent interest in the machinery under their care, and themselves perform the ordinary simple repairs so effective in keeping machinery, and especially boilers, in a constantly efficient and safe condition.

4. That the fuel obtainable is sometimes of very inferior quality, and I refer in particular to certain classes of native coal, which besides combining a large proportion of dirt (up to as much as 30 per cent.), invariably contains an undue proportion of sulphur.

The presence of this element in quantity makes it most unsuitable as a steaming coal, especially in the class of boilers adopted here, as it attacks the *iron* boiler tubes (very few indeed are of brass in this district) with quickly disastrous results.

The price of English coal (£17 10s. per ton in Kimberley) makes it prohibitive for use in boilers, but I cannot doubt that when the railway is advanced to this district, steam users here will avail themselves of this class of fuel in preference to all others.

The native coal used here has mostly been mined in the Free State, and the market price has fluctuated between £10 and £14 per ton.

I estimate that good Welsh engine coal will be delivered here, at ordinary colonial rates of transport on railways, at about £8 per ton, when the line *via* Hope Town is completed to the Diamond Fields, and reducing the approximate amount of combined wood and native coal used during 1882 at the four principal mines, to an average quality of English coal equal to the same steaming capabilities.

I estimate the saving in fuel to mining companies could not be less than £150,000 per annum.

I have reckoned out the annual expenditure in fuel at present at the four mines, as approaching £600,000, and the amount of Welsh coal that would steam the boilers at the present output of work, at 55,000 tons per annum.

An analysis of a good sample of coal gained in a neighbouring province, *has been stated to me* to yield

78·2 per cent. of carbon  
and 7·2 per cent. of ash,

which very fairly approaches the average composition of British coal used for locomotives, &c.

A Government report gave this analysis at

80·4 per cent. of carbon  
and 4·0 per cent. of ash.

Against this, however, I must remark that I have seen ashy coals brought here unable to support combustion or make a fire of itself, being in fact nothing more than a carbonaceous shale.

5. That the water steam users on the Diamond Fields have until now had to contend with, is unsuitable for use in boilers, on account of its extreme hardness. (a) The water pumped from the mines and vlees frequently holds



a large amount of mud in mechanical suspension, and also contains in chemical solution, carbonates, and very often a varying proportion of sulphates of limes in what must be considered dangerous quantities.

(b) The *best well water* (formerly termed "De Beer's Water") being used for drinking purposes, commands a good price on the Fields. Depending on the supply in the wells the price varies from 2s. 6d. (two shillings and six-pence) to 5s. (five shillings) per barrel. It is generally met with at a depth of something over 100 (one hundred) feet from the surface of the Kimberley red soil; it is fairly soft in nature, and does not throw nearly so much deposit in boilers as compared with the mine water above referred to.

The question then naturally arises to steam users whether they should use the cheapest water obtainable, viz.: that pumped from the "vleys" or claims in the mine, and allow the risk of foulness to exist in their boilers, at the certain loss, however, of efficiency of the boiler and the wasteful use of fuel, as also a very likely cause of deterioration in the boiler on account of this accumulation of deposit, *i.e.*, the fire-box plates and tubes being burnt by their overheating, should this limy deposit be suffered to collect.

The other alternative for steam users is to use *well water* at a considerably higher initial expense, and by "blowing off" (to waste) any dirty water as deposit begins to form, preserve the boiler in a state of cleanliness, and thus secure economy of fuel, in comparison with the former case, and not running the extra risk of the failure of those important parts of boilers exposed to the fire.

Many mining companies avail themselves of this latter water, or at any rate, use it now in part, and with the shortly expected arrival of water from the Vaal River, by the Kimberley Waterworks Company's pumping system, at the proposed cost of 1s. 3d. (one shilling and three pence) per hundred gallons.

I hope and believe the undoubtedly *more* costly system in the long run, of using cheap mine water with its attendant evil of quickly choking up boilers fed with it with deposit, will gradually disappear in favour of the purer and more suitable water in every way, than perhaps its initial expense.

## CHAPTER V.

### WHERE DANGER IS APPREHENDED AND FOR THE PREVENTION OF ACCIDENTS.

Omitting the great number of risks that a large body of workers are always exposed to on account of their own want of ordinary forethought or care, I believe that the dangers existing to workers at, or about these diamond mines by virtue of the special class of machinery used, may be classified as follows:

1. Accidents may occur to enginemmen, or their helpers, at, or about engines or boilers under steam, or at washing machines in work, or to men working near tip stages, or tipping boxes, (a) from the want of proper fencing or protecting guards, to moving parts of machinery; (b) by the failure of the boiler or any part of machinery, or the breaking of the steel ropes used as hauling or standing wires, by reason of the weakening effects of corrosion or wear, through age, or unforeseen causes, such as latent defects in material or bad workmanship; (c) from sheer negligence or inherent incompetency of the men in charge, including engine drivers, who by unsteady driving, or inattention to signs of failure in any portion of the machinery, run risks that they themselves, even, are sometimes unaware of.

2. Accidents are also liable to occur for apparent reasons in the mines to men working under, or about the aerial tramways, or to persons being pulled up, or lowered by, the tub carriages from, or into the claims, by reason of the instability of the balance of the tub and the swinging of the standing wires, or by over-winding.



3. Accidents have frequently occurred on tramways where horses pull the trucks, whereas I have no record of an accident where locomotives have been used. The latter system appears to me safer, in that the driver has brake-power sufficient to pull up a train of trucks, whereas a horse, being only attached by a loose chain, can exert no retarding influence on loaded trucks. The tramways being, more often than not, laid on inclines, the danger appertaining is appreciable; in fact, there are several instances of drivers having fallen off the trucks they were riding on, and received contusions from which they have died.

However, with a view to ascertain from responsible persons, reliable and independent versions of the causes of accidents, as also, if possible, to guard against similar future occurrences, the respective Inspectors of Mines on the Vooruitzigt Estate and at Du Toit's Pan, have incorporated suggestions of mine in general orders, to the effect that claim-holders (or their accredited agents or managers) using machinery or gears within mining areas, must report personally, or in writing, details of any damage or breakages occurring, to the Inspector of Machinery.

These orders for safety were promulgated by the Inspector of Mines on the Vooruitzigt Estate in his Standing General Order No. 11 of 1882, and by the Inspector of Mines at Du Toit's Pan, by No. 1 of 1883, and the orders as affecting machinery, read as follows:—

(a) REPORTING DANGER.—When any person employed in mining operations shall apprehend danger to himself, or others, on account of the unsafe position, state or condition of machinery, plant or gear, or of pathways or ladders, or of careless conduct of those in charge of such (*e.g.*, careless engine driving),.....or from any other preventible cause whatsoever, he shall report the same to the manager of his company or firm, or to his employer, and such manager or employer, after having without delay satisfied himself as to the reality of the danger so reported, shall at once cease work in, and remove his labours from, the position of danger, or stop the machinery &c., found to be unsafe, carelessly managed or controlled, until the cause of the danger has been removed.

(b) In cases of breakage of hauling or standing wires, or damage to machinery or gear, the nature of such breakage or damage must be reported within twelve hours to the Inspector of Machinery.

(c) Previous to starting any new engine, steam boiler, or hauling or lifting gear, and previous to resuming work with any machinery or gear after disuse thereof for a period exceeding four weeks, and before filling up any pit in which standing wires are anchored, on bank or below, managers of companies and firms must give at least twenty-four hours' notice to the Inspector of Machinery, in case he may deem it necessary to make preparatory inspection.

(d) When engines, or boilers, are to be stopped for repairs, or for being thoroughly cleaned out,—especially with reference to manhole covers, &c., being taken off for inward inspection of boilers—at least twenty-four hours' notice should be given to the Inspector of Machinery, in order that he may have an opportunity of being present should he wish to be so.

## CHAPTER VI.

### PROPOSED REGULATIONS TO BE OBSERVED BY FIRMS USING STEAM BOILERS, ENGINES, &c.

After careful consideration of the possible prevention of accidents, I have drawn up the following code of regulations which, if generally enforced in the mines of Griqualand West, cannot, I think, but tend towards establishing better and more uniform safety where machinery is employed: they principally affect the working of boilers, as it is from this quarter that the danger of failure (resulting from former neglect) is, in my opinion, becoming more appreciable day by day.



1. FENCING TO MACHINERY.—All fly-wheels of engines, or quickly moving parts of machinery—when persons for sufficient reason can pass near them—to be securely fenced in with suitable guards.

2. BRAKE POWER FOR HAULING GEARS.—In all geared hauling engines, the winding drum or drum-shaft, &c., be fitted with a suitable brake with foot lever, &c. (or other improved method of working it),—this brake to be quite independent of the brake that is generally affixed to the engine itself in order to enable the engine-driver to have effectual control of the hauled tub carriages, or trucks running on an incline, should anything go wrong with the crank-shaft or geared wheels, &c.

3. INDICATOR FOR HAULING GEARS.—When any aerial hauling gear is particularly availed of for hauling men out of the mine, a reliable indicator shewing the engine-driver the position of the tub carriage, &c., on the wires must be arranged in the engine house.

4. FOR EXAMINING STANDING WIRES.—All standards, or jumpers, and tipping boxes supporting standing wires to be provided on the outside with a suitable ladder or steps, convenient to the bearings on which the wires rest, to afford facility for their proper and systematic examination, even while tubs are being hauled.

#### BOILERS.

5. TESTING BOILERS.—When a thorough examination of any boiler (he regards suspicious) may be ordered by the Inspector of Machinery, the proprietor must supply any assistance or appliances required, as also to afford the Inspector of Machinery every facility for making such inspection.

6. HYDRAULIC TEST.—Should the Inspector of Machinery consider it necessary to subject a boiler to hydraulic test, it must maintain the following pressure during the time necessary for examining every part of the boiler. For a new boiler, the proof pressure must not be less than  $1\frac{1}{2}$  times the working pressure, and for a boiler that has been in use, not less than  $1\frac{1}{4}$  times the working pressure.

#### MOUNTINGS ON BOILERS.

7. TEST COCKS AND WATER GAUGES.—Every boiler to be fitted either with a glass water-gauge, and a set of test cocks of “straitway” construction, or with two glass water-gauges, each with independent connections to the interior of the boiler.

8. WATER LEVEL.—The lowest limit of the working water level of every boiler, or the relative height of the crown plate of the fire-box, to be conspicuously marked either by a brass plate or pointer placed immediately behind the tube of the glass water-gauge, or by a distinct white line painted across the plate on the stoking side of the boiler, with words signifying its meaning.

9. STEAM PRESSURE GAUGE.—Every boiler to be fitted with an efficient steam pressure gauge, having a distinct mark on the dial plate indicating the highest stipulated working pressure. Otherwise the maximum working pressure allowed, to be distinctly painted in bold figures—not less than three inches in height—either immediately above, or below the fire-box of the boiler.

10. If considered advantageous by the Inspector of Machinery, any boiler at his direction to be fitted with an extra branch nozzle, to which his standard pressure gauge can be easily temporarily attached for purposes of comparison.

*Note.*—In ordering new boilers or mountings, proprietors would do well to specify that the steam pressure gauge attachment should be fitted with a cock (and suitable nozzle as above), so that the efficacy of the pressure gauge might be readily tested occasionally by shutting it to the boiler, and opening it to the atmosphere.

11. SAFETY VALVES.—Every boiler to be fitted with at least 2 efficient safety valves—one of which must be a “lock up” valve, or one that cannot be



tampered with,—which must have adequate combined steam-way area, to release so much steam as to prevent the pressure in the boiler exceeding the limit allowed, no matter with what intensity the fire is burning.

12. FEED TO BOILERS.—Every boiler to be provided with at least two independent feed apparatus, preferably a donkey pump, and an injector, each of which must be able in itself to supply the necessary quantity of feed water.

13. MANHOLES ON BOILERS.—On every boiler one manhole, at least, of ample size (and convenient to the fire-box where possible) must be provided in order to afford adequate means of examining the interior of the boiler, and to be fitted with an easily detachable cover tightened up by two bolts.

14. BOILER HOUSES, &c.—For readily identifying boilers, engines, hauling gears, &c., the name or initials of the owners to be painted in bold letters, on two sides of such engine houses, tipping boxes, &c., viz. :—the sides facing the mine, and the side in engine houses in which the entrance is formed. When more than one gear is owned, the distinguishing number of such to be painted below the owner's name.

15. SYSTEMATIC INSPECTION OF WIRES.—A competent person to be appointed by every firm using hauling gear, who shall at least, once in every 24 hours, examine the state of all hauling or standing wires, and shall keep a true report of every such examination in a record book kept for that purpose, and which shall be at the service of the Inspector of Machinery, whenever he may require it.

16. FIRING UP OF BOILERS.—At the firing up of boilers, a responsible person, other than a Kafir, to be present, to see to everything being in order.

## CHAPTER VII.

### USING EXISTING GEARS FOR TRANSPORTING NATIVE LABOURERS FROM AND INTO THE MINES.

The providing of safe and adequate means of exit for the large number of native labourers, and others employed in the deep diamond mines, does not appear until very recently to have commanded the attention that, in my opinion, the question deserved, as it is manifest that the difficulties and dangers of getting to and from work in the claims as the workings become deeper, increases at a quick ratio of proportion.

The Kimberley mine, on account of its great depth at a quick slant, as also from the instability of the main reef, offers only very treacherous foothold on many of those tracts of exit from all sides of the mine, that the native labourers, in their daily scrambles, have made for themselves.

I was considerably surprised on this account, to find the Kimberley Mining Board raising objections, to what I considered, most reasonable and practical propositions by the Inspector of Mines on the Vooruitzicht Estate, for the making of certain pathways in the mine, as also the placing of ladders in certain places for the safety of Kafirs getting up and down steep places, and thus avoid putting persons at a lower level than themselves in jeopardy, by starting loose lumps of earth and rock from immediately above them, either while those below were at work, or while scrambling up behind the others.

Equally astonished was I to read the report of the Mining Board's Engineer on the subject, with his proposition that Companies should be obliged to employ their existing pulling gears, as a mode of transport for labourers to and from the mines.

When it is considered that the working hours in the mines are from sunrise to sunset, the loss of valuable working time to some companies in pulling up or lowering their boys into the mine, could not amount to less than some hours per diem for four journeys, and to this must be added the cost of driving the hauling engines for this extra purpose.

I believe difficulty would arise in inducing many Kafirs to ride in these carriages, which, at any rate, must be described as hazardous-looking contri-



vances, but apart from these considerations, I am distinctly of the opinion that the Engineer to the Kimberley Mining Board, by his proposal, quite under-estimated the dangers to life and limb that would obtain, were existing gears to be used for hauling large numbers of men up and down the mine.

At the request of the Inspector of Mines, I reported on the subject to the following effect:—

“I consider the existing tubs, and general hauling arrangements, as ‘singularly precarious and unfitted to transport any persons other than those of assured prudence, and before I could approve a general extension of this mode of conveyance, to and from work, of a mass of native labourers, I should feel bound to insist on some such additional refinements to the gears as follows:

“1. Guards fixed over the moving parts of the carriage (wheels, axles, &c.), and a locking arrangement to the tubs to prevent their tipping over. Many existing tubs would have to be ‘re-hung,’ as having their ‘centre of gravity’ too high, they are too ‘top heavy’ in their swing.

“2. ‘Safety’ grips to be attached to the tub carriage for acting on the standing wires in case of breakage of the hauling wire, or the carriage wheels leaving the wire and, either a safety ‘detaching hook’ or link to be attached to the hauling wire to prevent ‘overwinding,’ or suitable ‘stops’ to be fixed on the standing wires behind the jumper or standard (as the case may be).

“3. Landing platforms, properly fenced in, to be provided at all stopping places, and a suitable buffer arrangement made at the anchorings in the mine.

“4. An efficient indicator to be arranged in the engine house shewing the exact position of the tub carriage on the wires; and more positive means than obtains in most cases at present, for communicating definite and distinct signals from stopping places to the engine driver.

“5. More frequent and skilled inspections to be made by Companies of their hauling and standing wires, than I am satisfied is the rule with many of them at present.”

Probably at no distant date the exigencies of the Kimberley Mine will require that labourers should be carried by gears to and from their work in the lower levels of the mine, but for this service I must recommend that only a specially designed and approved arrangement should be allowed.

## CHAPTER VIII.

### QUALIFICATIONS OF ENGINE DRIVERS, &c.

The subject of the qualifications of men employed to drive engines is one, I contend, of considerable importance, and surrounded at the same time with much difficulty.

I distinctly believe that the compulsory holding of a certificate of competency by persons employed as engine drivers, boiler attendants, &c., would be a guarantee to a certain extent to careful driving, &c., and as a natural sequence to the prevention of many accidents, and what I have seen of this class of men on these Diamond Fields, in a very marked degree, corroborates my experience gained in England in previous years of contact with persons in charge of engines and boilers.

The subject of the prohibition of any but duly qualified and certificated persons taking charge of steam engines or boilers, has been under discussion for a very long time in England by Trades’ Unions, Miners’ Unions, and others, and has been frequently pressed under notice of the Imperial Parliament, still the question has not been considered fully argued out, or ripe for legislation.



Preliminary interference by Government Inspectors before danger is shown to exist, viz.: before the competency or otherwise of engine drivers, &c., has been proved, would, I opine, be going beyond the province of their jurisdiction, but I think the great importance of the subject will be generally allowed when it is remembered that every day it can fairly be said, the lives of many persons are endangered by the inexperience or incompetency of those whom it has been sought to bring under a compulsory Government examination.

My impression, however, is that such a refinement (as compulsory examination of engine drivers, &c.) in the existing state of the mining industry here, would be quite impracticable, and my local objections are as follows, and are the substance of a report I made on the subject to the Inspector of Mines at Du Toit's Pan, who asked my opinion on the matter a few months ago.

1. That the compulsory examination of engine drivers would be such a radical change from the existing state of affairs, and so immediately affecting the welfare or safety of miners themselves, that the proposition should emanate directly from that body.

It must be presumed that safety to life and limb by claimholders and managers, as also for their employes, is, *ipso facto*, zealously looked to by the employers of labour themselves.

Also that the economical working and "life" of their machinery, or gears depending to so large an extent on the men in charge of engines and boilers, the employers would naturally of their own accord try to get the best men possible. Thus I argue Managers of Companies should satisfy themselves as to the competency of their servants, as also themselves make any arrangements for a test examination as to the experience of those who seek engagement.

Where cases of actual incompetency on the part of drivers come to knowledge, I may add that I regard asking employers for their dismissal, by means of a "Notice for Safety," as quite within the duties of the appointment of an Inspector of Machinery, but I hold that the initiative confidence to employ men to drive engines, or look to the safety of the boilers, should originate from steam users themselves.

2. That a great hardship might accrue to Mining Companies in that I am not convinced there would be a sufficient number of men who would present themselves for examination, as are actually required for driving the engines used on these Fields, possessed of reasonable confidence that they could pass such a compulsory examination as to their competency to take charge of engines or boilers.

3. That technical knowledge would count for perhaps more than it is worth, in that general steadiness and sobriety are undeniable primary qualifications for attendants to the usual type of engines and boilers used in this mining district.

The manufacturers of the class of machinery in general use here, have very fortunately, during latter years, paid attention to details in the direction of making the manipulation of the gears as simple as possible.

The Inspector of Mines at Du Toit's Pan further asked me if I was "prepared to undertake the examination of such men as are employed, or may "present themselves for employment as engine drivers, and to grant certificates "to those whom you may find qualified.

In reply, I stated that were I officially appointed, I would be quite prepared to undertake such duties, but I expressed an opinion that should compulsory examination at any future time be brought about, that both to the establishing of confidence in its efficacy, as also for avoiding personal odium, it could only satisfactorily be effected by a Board of Examiners, and it appears clear to me that the form and details of examination should emanate directly from the Legislature.

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## CHAPTER IX.

## UNECONOMICAL FEATURES OF THE AERIAL HAULING SYSTEM.

In comparing the cost of hauling by inclined aerial tramways with the system adopted, for instance in coal mining in countries all over the world, viz. : vertical shafts with drives to the ground to be won, I cannot but express an opinion that the aerial gears shew to a great disadvantage in the working expenses, and I think this is especially apparent as the majority of the gears are decidedly too small to cope with the work economically.

The standard types of tubs and trucks have a capacity of 16 cubic feet, which it is fully agreed among practical men could much more advantageously have been, *at least*, half as large again (*i.e.*, holding 24 cubic feet), if not with a 32 feet capacity, as a few of the more modern gears have been arranged.

Unfortunately for many considerations, very few of the existing gears would allow the modifications required for replacing the smaller by larger tubs or trucks.

Then too the system does not compare favourably with modern mining practice, on account of the modified possible speed of hauling tub loads of ground out of the mine compatible with the certainty of the carriage wheels (on various considerations) keeping on the standing wires, and thus making good constant use of the engine power, as against winding up vertical shafts where these hindrances to quick winding do not exist.

The following is the best average day's work of an aerial gear that has come to my notice.

From sunrise to sundown, or 11 hours of actual work, 645 tub-loads of 16 cubic feet capacity (equal to about 230 cubic yards solid measurement), were hauled from a depth of 200 feet, with a winding engine of 12 nominal horse-power, and with an expenditure of fuel about 4,200 lb. of wood, giving an average of 61 seconds of time for each tow and its stoppage.

This amount of hauled work done is, I estimate, not half as much as would be performed by suitable gear and a vertical shaft in ordinary coal mining.

In support of this statement, I append particulars of a day's winding done at a well known colliery in Scotland, with perfect safety as regards speed.

In a shift of  $9\frac{1}{2}$  hours there were drawn from an average depth of 432 feet, 1,166 hatches of coal (equal to about 550 cubic yards solid measurement, or 530 tons in weight), and as the miners were likewise drawn up during this shift, the average time for lifting a cage was less than half a minute.

Then again the general system of using special tub carriages on aerial gears, instead of hauling up directly the tramway trucks in a sling cage arrangement, as obtains in a few cases, is distinctly another departure from economical working, in its requiring the extra and seemingly useless operation of emptying the hauled ground from the tub when it arrives on the bank into a hopper, or tipping box, at the edge of the mine, and then refilling from here into trucks to be taken off to the depositing floors.

The system of pulling up loaded trucks in slings hanging from the frame sides of the carriages running on the wires, seems to require, it is fair to say, probably a slightly extra time for running the trucks in and out of the slings, as compared with the filling or emptying of the tubs pivoted on their carriages, but with systematic management the extra delay need not be a measurable quantity, and the gradual extension of sling-gears may be taken as testimony of its practicability.

The deeper workings of the Kimberley Mine, especially the lowest anchoring in which is now 420 feet below the level of the red soil, will probably before long necessitate, at any rate, a modification of the now obtaining aerial system, even though down to a depth of a few hundred feet (excepting in its costliness), it may have been found to answer well. Again,



the expensive system of hauling in the Kimberley mine is forcibly exemplified, in my opinion, in the extraordinary high tariff paid, and fixed by the Kimberley Mining Board for the removal of reef.

The present rate is 3 shillings and 9 pence \* per truck load of 16 cubic feet of loose stuff (averaging about 10 cubic feet of solid), or equal to a rate of over 10 shillings per solid cubic yard, for removing "fallen reef" from claims (say at a depth of from 200 to 400 feet), and 2 shillings and 9 pence for the removal of solid (but very rotten) reef lying above the hard bed rock equal to a tariff of 7 shillings and 6 pence per cubic yard, solid measurement.

An amount of continually shifting reef, probably at a moderate estimate, not far short of half a million cubic yards on the east side of the mine, has at present to be coped with to clear the claims of Mining Companies on that side, but instead of boldly meeting this hindrance to profitable mining work, we find a 16 horse-power winding engine drawing 500 16 feet truck loads up an incline, about 50 feet deep, and another 16 horse-power winding engine, pulling about 650 16 feet-tub loads to the surface of the mine, up a shaft about 100 feet deep, and this reef in both cases is then loaded into railway trucks, and tipped at a place about one mile distant, equal to an aggregate removal of about 420 solid cubic yards per diem.

This result indeed seems small when compared with the amount of reef to be coped with, and I cannot but think that a broader and more practical system, would pay a contractor well, even with a much reduced tariff.

More uneconomical still does the removal of water from the claims in the Kimberley Mine appear to be.

The contractors (who are the Mining Company working at the lowest level in the mine) state that it costs them 13 pence for what the Mining Board only pays at the rate of 6 pence per hundred gallons, the water being lifted from a depth of about 420 feet. It is raised by an aerial gear in similar buckets to the tub carriages for hauling ground, and, by means of a valve in the bottom of the bucket, the water on reaching the surface of the mine is emptied into a tank, which then is allowed to run waste, though virtually a portion of it finds its way to a neighbouring vley.

The average daily quantity of water raised is about 44,000 gallons, and is performed by a geared hauling engine, with semi-portable locomotive type boiler, at a cost of wood feed equal to a ton of fairly good coal per diem.

This duty should be done, I do not hesitate to say, by a direct-acting pumping engine, fixed at the bottom of the mine, at about half that cost of fuel, but with this latter system a difficulty arises in the constant damage liable to occur to machinery in the mine, by the incessant heavy blasting, as also by the necessary shifting and making new connections as the working levels of the claims become lower.

I am informed that the water contractors had a pumping system previous to their present primitive mode of lifting water from the mine in buckets, but I am told the above hindrances brought the expense of removing the mine water to a price greatly in excess even of the present extravagant cost, as compared with the average results of ordinary pumping.

I record this as it has been given to me, and it is not for me to say here whether these difficulties to economical working should be as unsurmountable, as they seem to appear.

At the De Beer's Mine 12,775,000 gallons of water, or an average of thirty-five thousand gallons per diem, are raised annually, at a cost of £10,800, from a depth of about 280 feet, by a pumping system consisting of an ordinary horizontal pumping engine, with separate multitubular locomotive type of boiler.

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\*This reef tariff has, since writing, been reduced to 3 shillings and 6 pence per load of 16 cubic feet, commencing on February 1st, 1883.



## CHAPTER X.

## INSPECTION AND REGISTRATION BY STEAM USERS OF MACHINERY AND BOILERS.

The question of Government interference with steam users, and more especially in reference to enforcing independent periodical inspection of steam boilers, has frequently received attention from the Imperial Parliament, but until now a compulsory system of inspection has not received much favour in England.

In the absence of any direct instructions or statement, as to the feeling of the Cape Colonial Government on the subject, I beg humbly to submit my views on the matter as follows, which are in unison with the conclusions of a Parliamentary Committee on the subject, held in 1871.

I believe that sources of danger in machinery including boiler explosions are generally preventible by the exercise of such care and skill as steam users should be bound to employ, and therefore they must be held responsible for the efficiency of their machinery, and for employing competent men to work it. Further, I fully believe the truth of the argument "that it is doubtful whether compulsory inspection would not lessen the responsibility of steam users, who are best able to ascertain the condition of their boilers, and the competency of the men employed to work them."

I am bound to say that I believe a majority of the steam users on the Diamond Fields are anxious to keep their machinery and gears in good safe working order, even though it may involve a considerable expense, but on the other hand, I cannot overlook a certain class who seem to ignore the necessity of taking steps to ascertain the condition of their boilers and other machinery, and thus in their recklessness or negligence, run risks involving the lives of many persons in their employ, besides others.

On this account I am of opinion that certain restrictions might be enforced with great advantage in this mining district, and so bring home to this latter class a sense of the responsibility which at present, perhaps, they seem unable to appreciate.

I beg to quote recommendations of the Parliamentary Committee above referred to, as embodying my views on the subject.

1. That it be distinctly laid down by statute that the steam user is responsible for the efficiency of his boilers and machinery, and for employing competent men to work them.

2. That in the event of explosions, the onus of proof, or efficiency, should rest on the steam user.

If the above principles were enforced, I believe that the periodical inspections of boilers for steam users by independent persons would be fairly established, and I would further propose that all machinery and boilers under the surveillance of the Inspector of Machinery should be systematically registered.

Thus the Inspector of Machinery should have returns sent to him, giving complete information of all machinery in the possession of mining companies or individuals, together with particulars of any, or all, thorough examinations made of boilers, or important repairs done to machinery generally. And these records should furnish particulars in such detail, as to enable a fairly correct idea to be formed of the state of the boilers or machinery.

In Germany and France, compulsory systems of direct supervision by Government inspections have been adopted with hardly satisfactory results, as the proportionate number of boiler explosions in these countries, as compared with those in Great Britain, where no Government interference prevails, do not show a material diminution, while the expense to the State of keeping an adequate and efficient staff of Inspectors is a very considerable one.

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## CHAPTER XI.

AVERAGE DESCRIPTION OF A MINING COMPANY'S PLANT; LIST OF MACHINERY  
IN SITU AT THE PRINCIPAL DIAMOND MINES, &c., &c.

An average description of the gears and amount of machinery used by a Mining Company at any of the four larger mines, is shewn in the annexed statement, which I have filled in, and append as a specimen copy of about 150 Companies' Returns, sent in response to my request on forms I supplied.



RETURNS REQUIRED OF MACHINERY, &c., USED IN THE A. B. C. MINE.  
SPECIMEN SHEET.

S U M M A R Y.		E N G I N E S F O R M I S C E L L A N E O U S P U R P O S E S.							
NAME OF COMPANY.		THE X. Y. Z. MINE.		WASHING.		PUMPING.		OTHER.	
Total Number of Gears.				No. 1.	No. 2.	No. 1.	No. 2.	..	..
Total Number of Engines.	How many Hauling Engines	Two.		Six.	Eight.	Six.	..	..	..
	How many in use at present	One.		Robinson	Green.	Walker.	..	..	..
	How many Washing Engines	Two.		Vertical.	Horizon- tal.	Horiz. engine, ver. mult. boiler.	..	..	..
	How many in use at present	One.		2 years. 40 lbs.	12months 60 lbs.	6 months 60 lbs.	..	..	..
	How many Pumping Engines	One.		Yes. 40 lbs.	Not in use.	Yes. 60 lbs.	..	..	..
	How many in use at present	One.		Whether used constantly, and Present Working Pressure ..	Coal	8 bags.	..	..	..
	How many other Engines ..	None.		Approx. amount of Fuel used per week .. ..	Wood	2 cart loads.	See note	..	..
How many in use at present	None.		8,000	..	2 cart loads.	..	..	..	
Number of Horse Whims }	One			..	..	..	..	..	..
How many in use	One			..	..	..	..	..	..



TABLE No. 2.

GENERAL REMARKS.

## HAULING ENGINES.

		No. 1 Gear.	No. 2. Gear.	No. 3 Gear (Whim)	GENERAL REMARKS.
Approx. depth of Anchoring in Mine . . . . .		350 feet.	220 feet.	150 feet.	No. 2 Gear is seldom used and only when we are shifting or lowering anchor poles, or when a heavy fall of reef occurs.
Length of Rope required for a Standing Wire . . . . .		1,010 ft. from anchor to anchor.	300 yards.	100 yards.	
What length of time have existing Standing Wires been in use . . . . .		18 months.	3 years.	18 months.	
Have they been spliced in any part . . . . .		No.	Two splices.	No.	A cart-load of wood varies between 4,000 and 12,000 lbs. in weight.
Size of Standing Wire . . . . .		4½ ins. circumf.	3½ ins. circ.	2½ ins. circ.	
Longest span of . . . . .	From jumper on edge of mine to anchorings in mine (if unsupported) if with intermediate standard, state longest unsupported span here approximately.	760 feet.	..	..	
Standing Wires . . . . .		487 feet.	130 yards.	..	No. 2 Gear is seldom used and only when we are shifting or lowering anchor poles, or when a heavy fall of reef occurs.
How long have present Hauling Wires been in use, and their size . . . . .		4 months. 2¼ ins. circ.	1 month. 1¾ ins. circ.	6 months. 1½ ins. circ.	
Nominal Horse Power of Engine . . . . .		Sixteen.	Ten.	..	
Maker's Name . . . . .		Smith.	Brown.	..	No. 2 Gear is seldom used and only when we are shifting or lowering anchor poles, or when a heavy fall of reef occurs.
Type of Engine and Boiler . . . . .		Locomotive geared.	Loco. geared.	..	
Age and original working pressure . . . . .		3½ years. 75 lbs.	5 years.	..	
Whether in use constantly, and present working pressure . . . . .		Yes. 70 lbs.	Not in use.	..	No. 2 Gear is seldom used and only when we are shifting or lowering anchor poles, or when a heavy fall of reef occurs.
Approx. amount of fuel used per day . . . . .	Coal	None.	..	..	
	Wood	3,824 lbs.	..	..	
Size of Tubs or Trucks, stating which . . . . .		Trucks. 20 cub. ft.	Tubs. 16 cub. ft.	6 cub. ft. tubs.	No. 2 Gear is seldom used and only when we are shifting or lowering anchor poles, or when a heavy fall of reef occurs.
Average Number of Tubs pulled per day (with amount of load) . . . . .		364 (16 cub. ft.)		160	



TABLE No. 3.

TABLE shewing the total amounts of Machinery in work, or idle, in December, 1882, at the Kimberley, De Beer's, Du Toit's Pan, and Bultfontein Diamond Mines.

MINE.	HAULING GEARS.						WASHING GEARS.						Pumping and other Gears, or Engines, at the Mines, or on the Floors.						TOTALS.	
	Total Nos.		In Work.		Idle.		Total Nos.		In Work.		Idle.		Total Nos.		In Work.		Idle.		No. of Gears, or Engines.	Combined Nominal H. P. of Engines.
	No.	Nom. H. P.	No.	Nom. H. P.	No.	Nom. H. P.	No.	Nom. H. P.	No.	Nom. H. P.	No.	Nom. H. P.	No.	Nom. H. P.	No.	Nom. H. P.				
Kimberley ...	48	809	30	544	18	265	27	226	16	138	11	88	21	217	11	88	10	129	96	1252
De Beer's ...	26	342	14	208	12	134	20	162	12	100	8	62	19	137	7	48	12	89	65	641
Du Toit's Pan ...	49	650	31	459	18	191	42	437	30	329	12	108	42	256	25	134	17	122	133	1343
Bultfontein ...	29	376	21	264	8	112	30	271	21	203	9	68	23	151	12	63	11	88	82	798
Totals ...	132	2177	96	1475	56	702	119	1096	79	770	40	326	105	761	55	333	50	428	376	4034

Of these latter totals 230 Gears, representing 2,578 Nom. H. P., are in work at present, and 146 Gears, representing 1,456 Nom. H. P., are idle at present.



TABLE No. 4,

TABLE giving comparative particulars of the respective sizes and development, &c., of the Kimberley, De Beer's, Du Toit's Pan, and Bultfontein Mines.

MINE.	Area of Mine.	Number of claims in Mine.	Approx. length of axes of Mine measured over claim ground.		Depth of lowest worked claim from surface.	Approx. total amount of cubic yards of solid ground excavated.	Present number of individuals, or firms, holding claims.	Total number of hauling gears in position.
			North and South.	East and West.				
Kimberley ...	8.7	420	180 yards	300 yards	400 feet	6,600,000	39	48
De Beer's ...	9.7	610	210 yards	320 yards	270 feet	2,800,000	33	36
Du Toit's Pan ...	31	1490	150 yards to 260 yards	700 yards	197 feet	5,400,000	40	49
Bultfontein ...	22	1050	380 yards	100 yards to 360 yards	180 feet	4,500,000	35	29



Table No. 3 is compiled from the tabular forms I issued and caused to be returned to me completed, for the purposes of this Report, from all Mining Companies, or individual claimholders owning machinery in the four large mines, and I have drawn up and appended the latter table (No. 4) as interesting in showing, at a glance, the comparative features in the size and present state of development of the Kimberley, De Beer's, Du Toit's Pan and Bultfontein Mines.

(Signed) F. SCHUTE,

Inspector of Machinery.

Chief Inspector of Mines Office,  
Kimberley,  
February 14th, 1883.



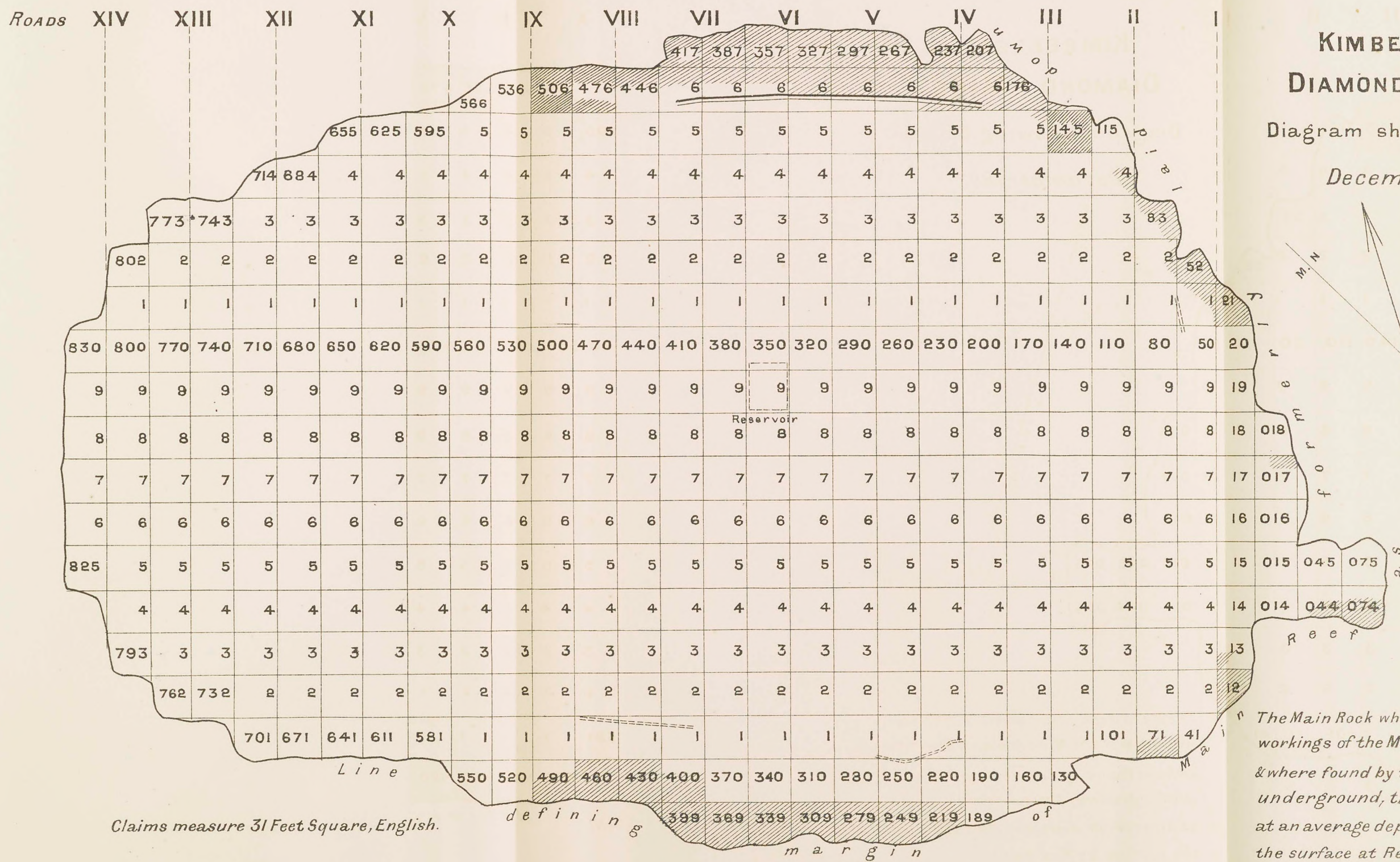
THE UNIVERSITY OF CHICAGO  
LIBRARY  
1100 EAST 58TH STREET  
CHICAGO, ILL. 60637  
U.S.A.

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CHICAGO, ILL. 60637  
U.S.A.

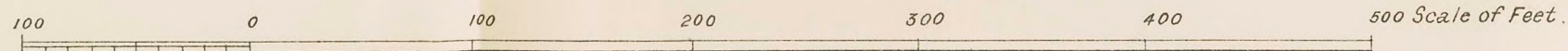
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A.



Claims measure 31 Feet Square, English.

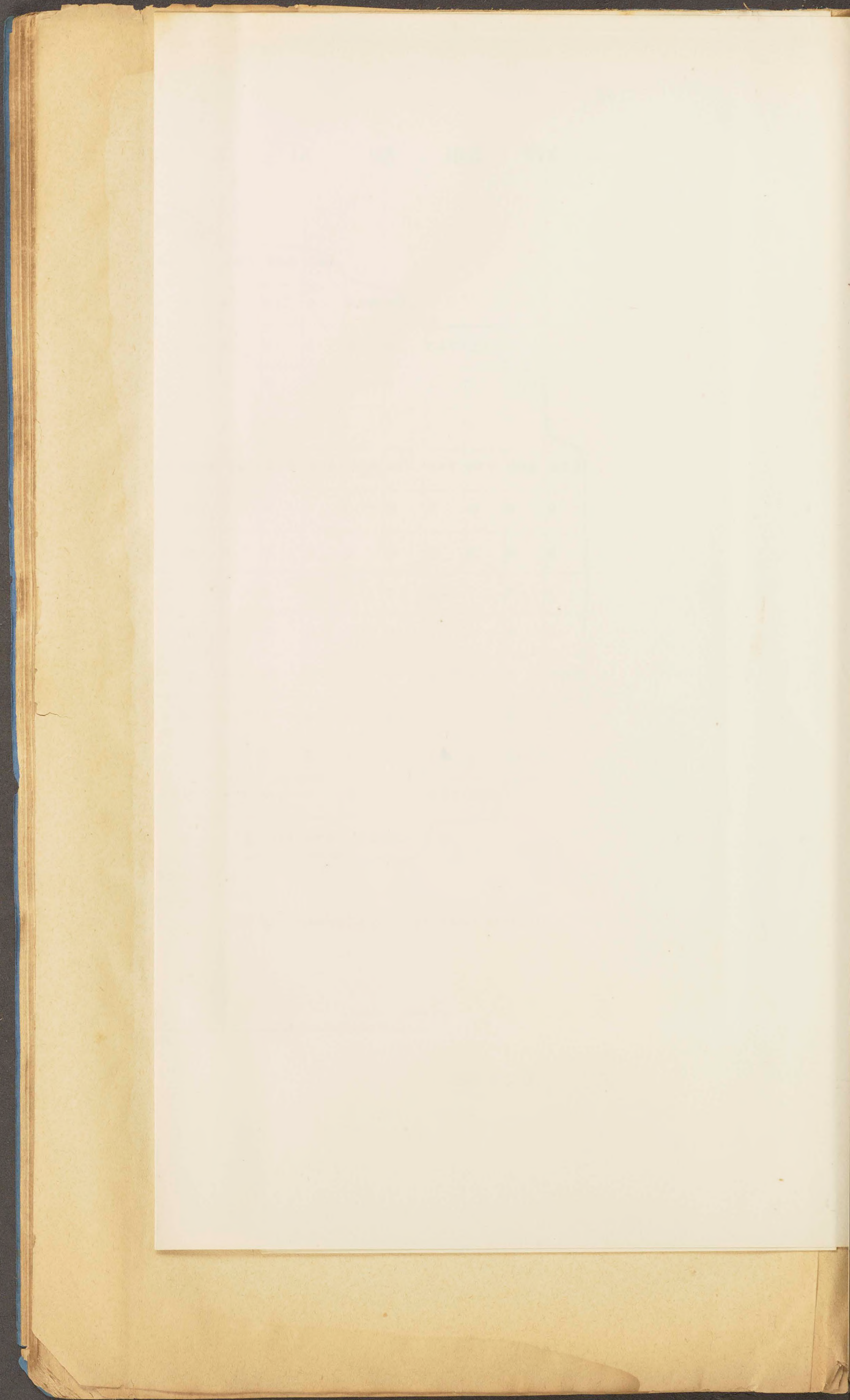


W.A. RICHARDS & SONS, Govt Printers, Litho.

C. 34. 83.

*Handwritten signature and date: 1.2.83.*





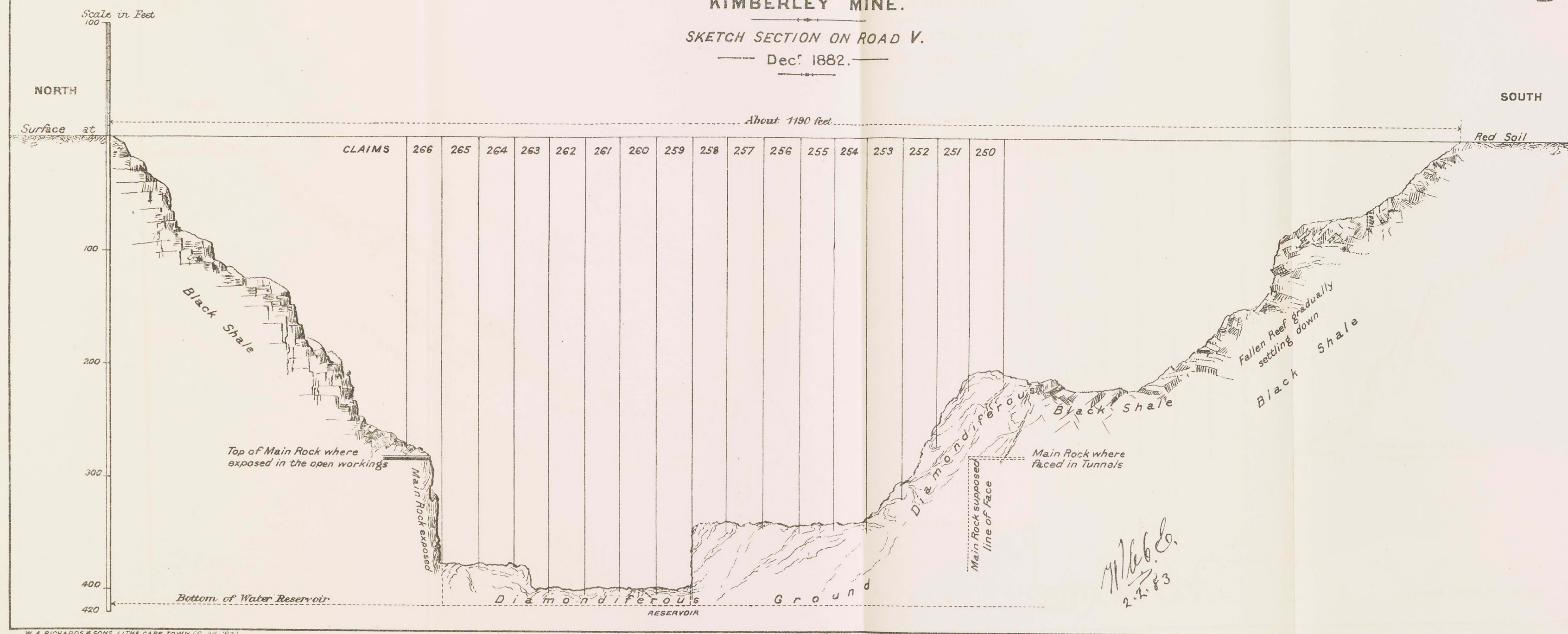


B

# KIMBERLEY MINE.

SKETCH SECTION ON ROAD V.

Decr 1882.



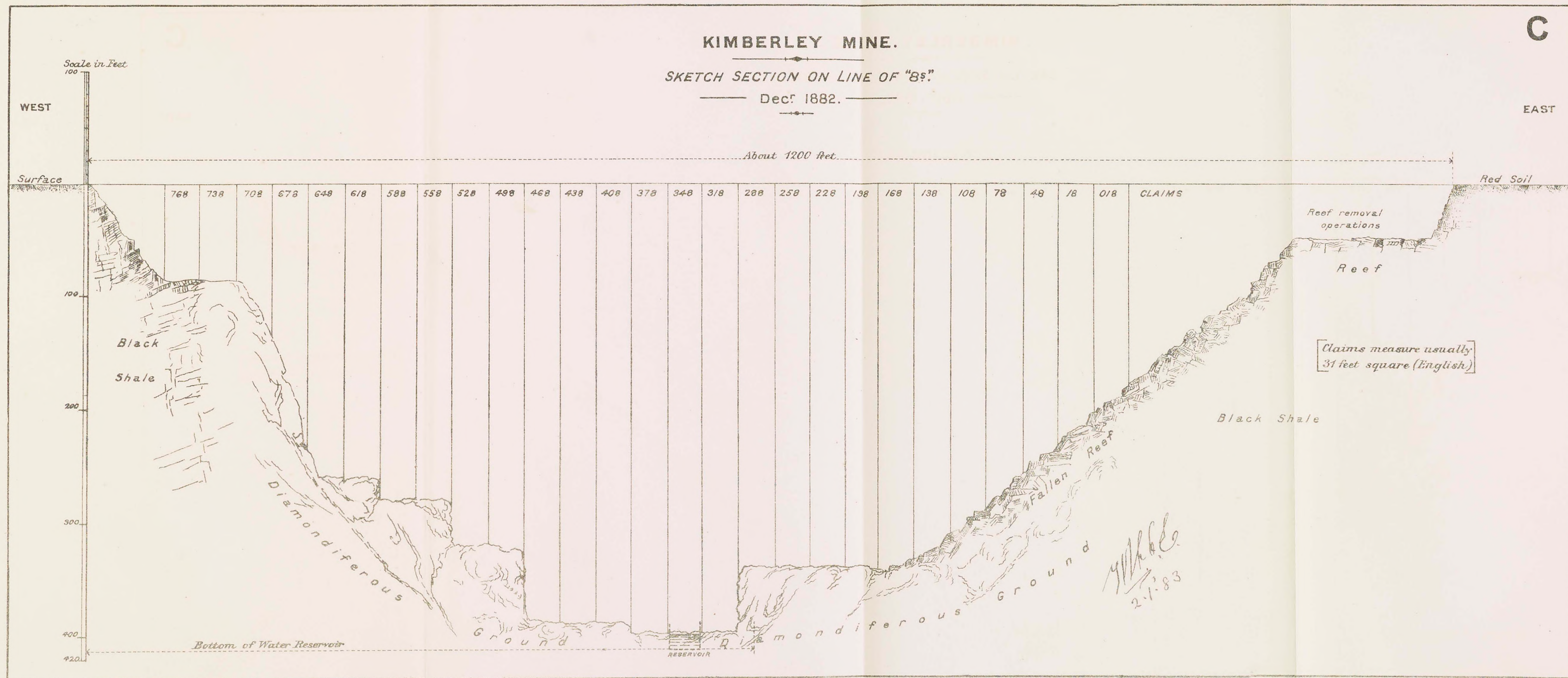
W. A. RICHARDS & SONS, LITHO, CAPE TOWN. (G. 34. 83)

400  
M. J. 6. 83  
2. 2. 83









W. L. RICHARDS & SONS, LITH. CAPE TOWN. G. 34. 93.

100

M. J. J. J.

Company

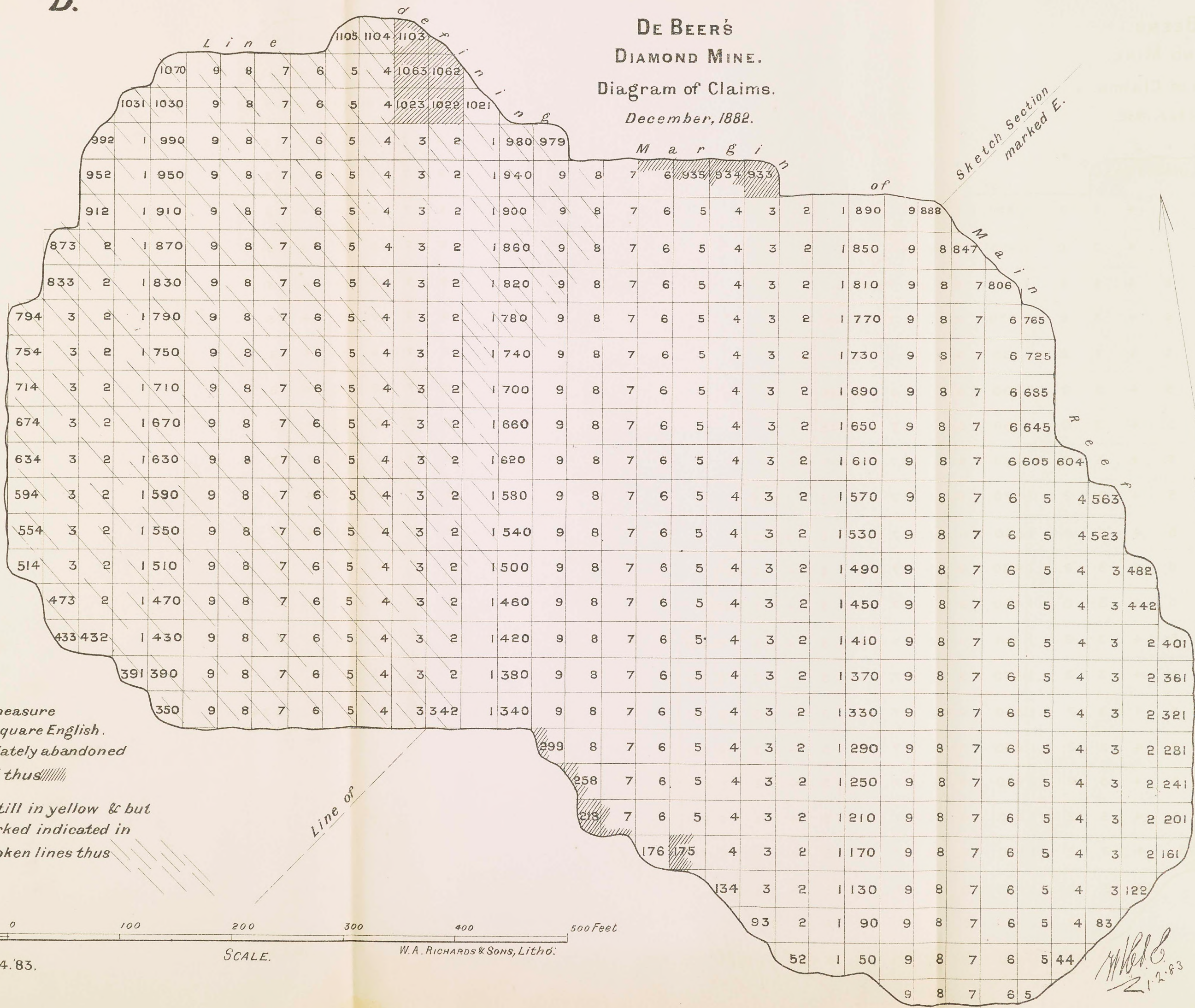






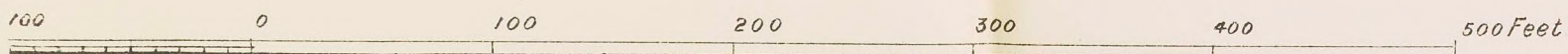
D.

DE BEER'S  
DIAMOND MINE.  
Diagram of Claims.  
December, 1882.



Claims measure  
31 Feet square English.  
Claims lately abandoned  
shaded thus

Claims still in yellow & but  
little worked indicated in  
faint broken lines thus



G.34.83.

SCALE.

W.A. RICHARDS & SONS, Litho.

*W.A. Richards*  
21.2.83

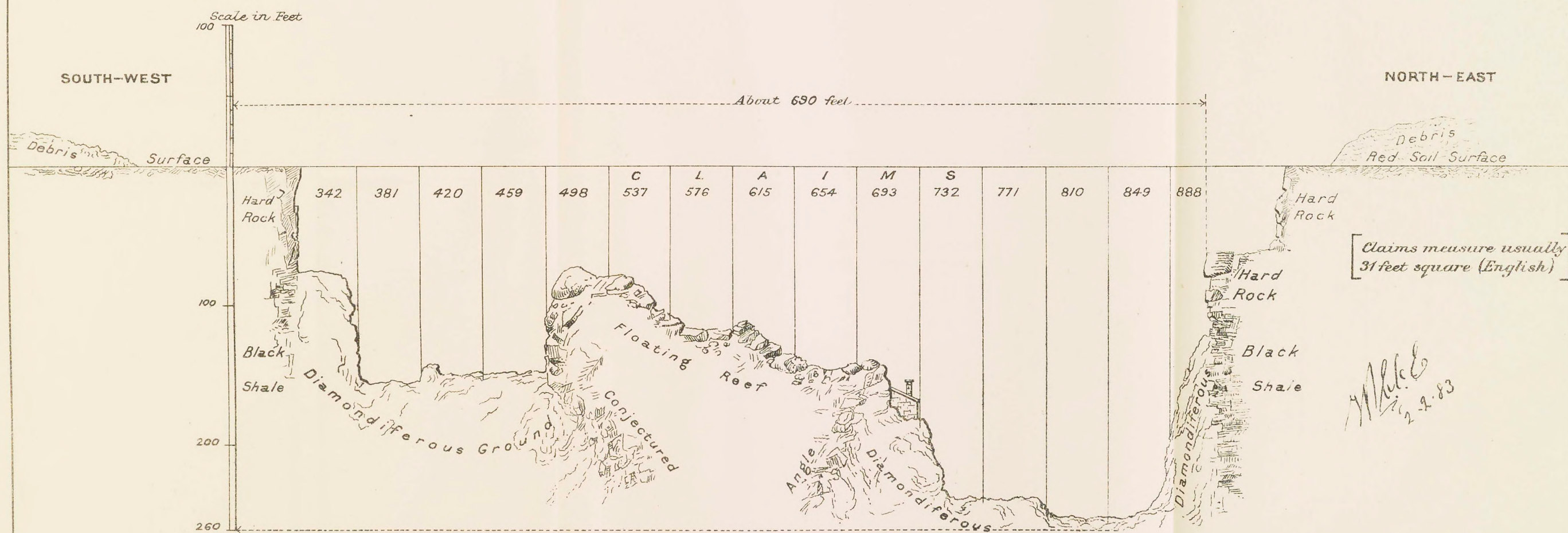






## E

Decr 1882.



W. A. RICHARDS & SONS, LITH'S, CAPE TOWN. (G. 34. '83)

Algernon Moreing Assoc. M. Inst. E.  
Chief Engineer of the French Company

W A RICHARDS & SONS LITH<sup>s</sup> CAPE TOWN (G. 34. 93)







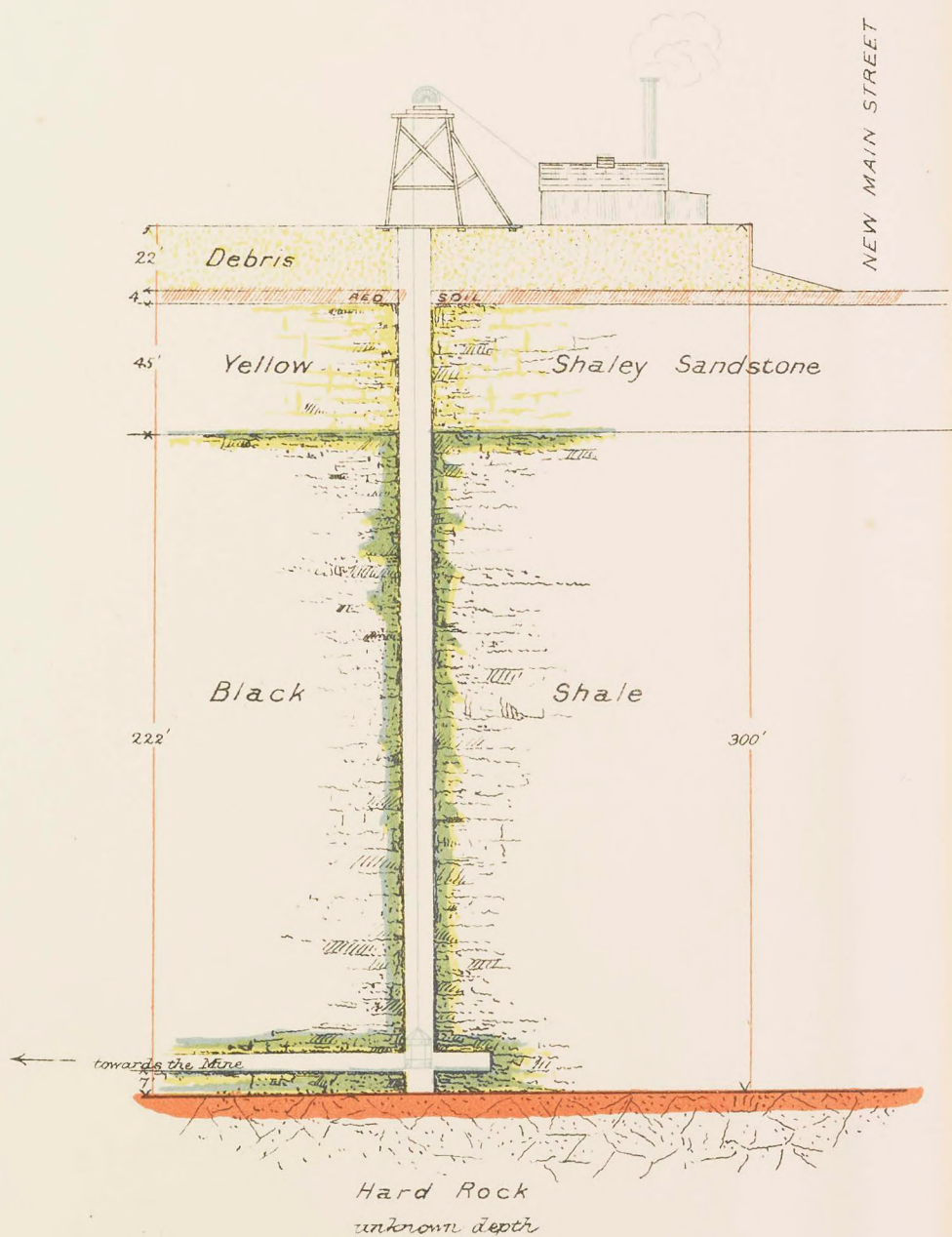
F

# KIMBERLEY MINE.

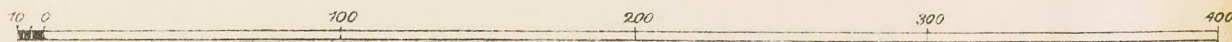
C<sup>IE</sup> FRANÇAISE DES MINES DE DIAMANTS DU CAP.

## SECTION OF SHAFT

Showing the Strata.



### SCALE



*Belgion Moreing Assoc. M. Int. &  
Chief Engineer of the French Company*





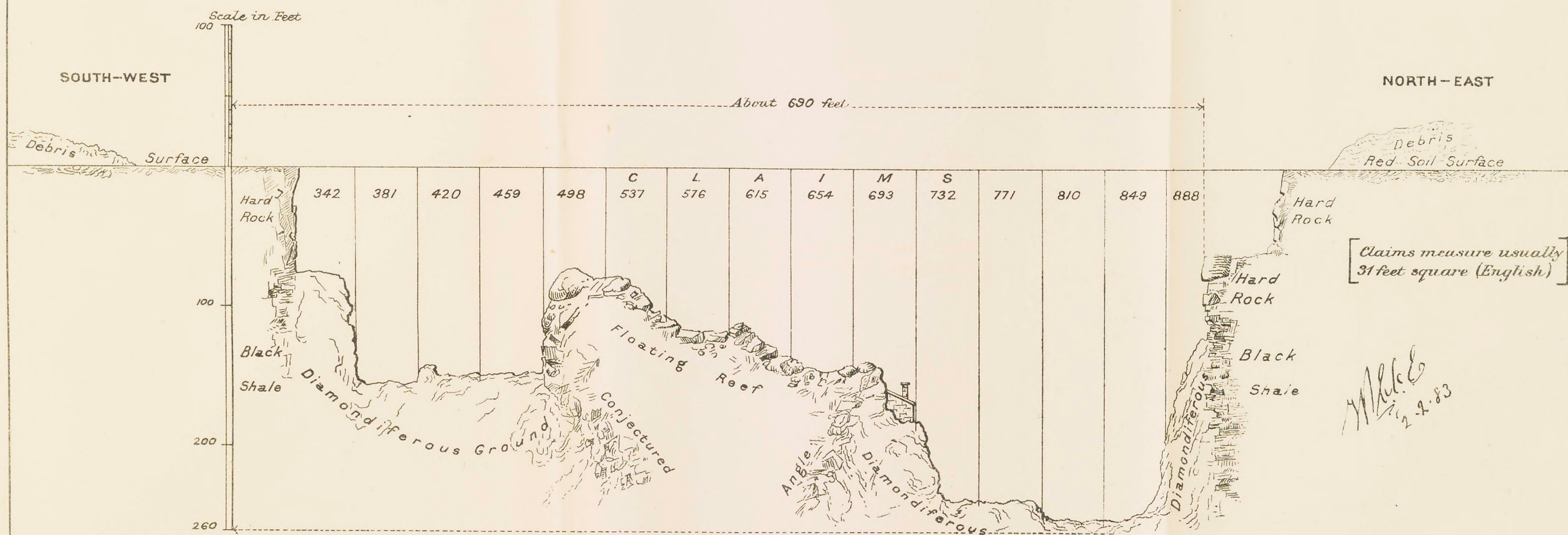


E

# DE BEER'S DIAMOND MINE.

SKETCH SECTION ON DIAGONAL LINE, CLAIM 342 TO 888.

Dec<sup>r</sup> 1882.







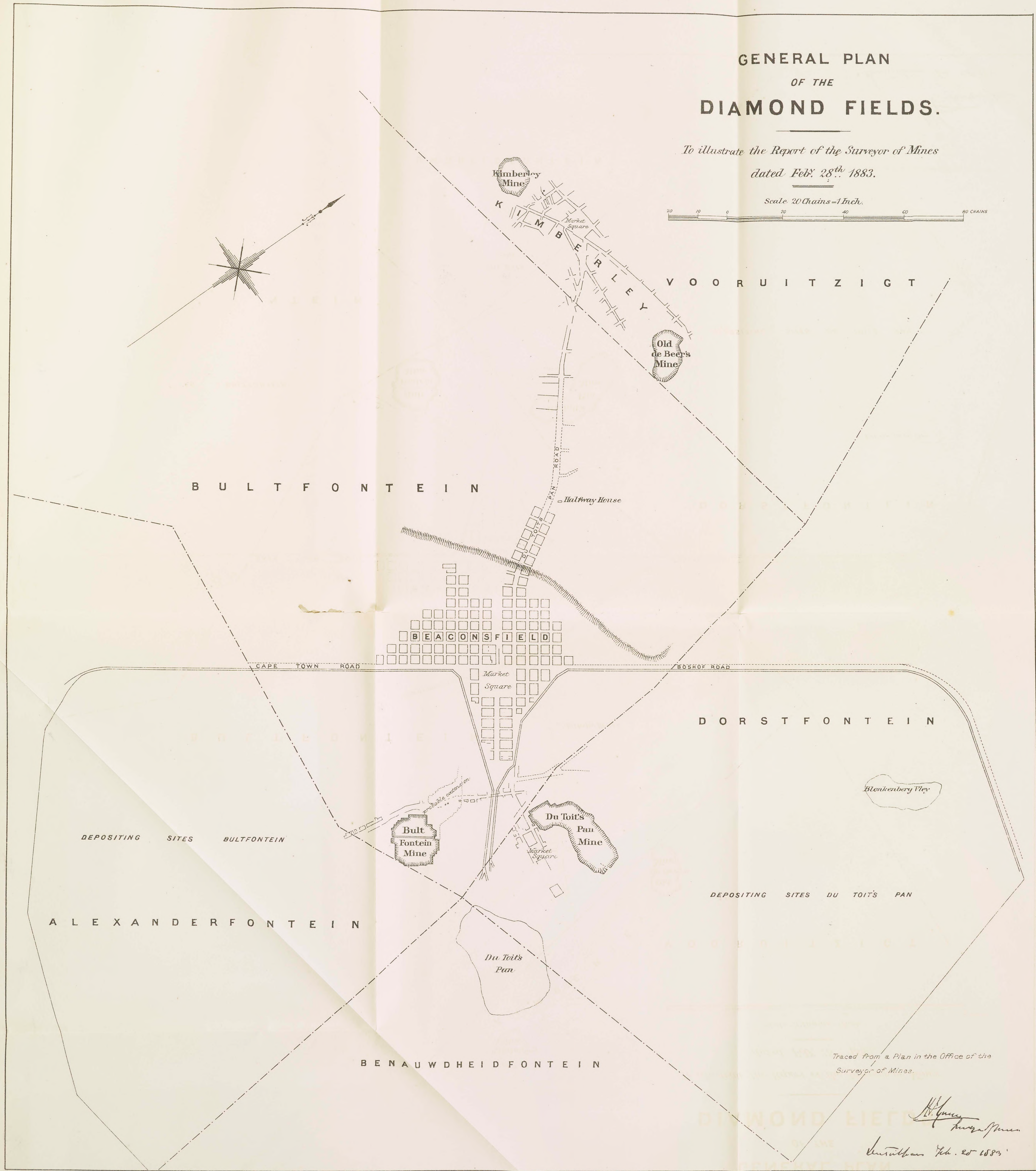


# GENERAL PLAN OF THE DIAMOND FIELDS.

To illustrate the Report of the Surveyor of Mines  
dated Feb. 28<sup>th</sup> 1883.

Scale 20 Chains = 1 Inch.

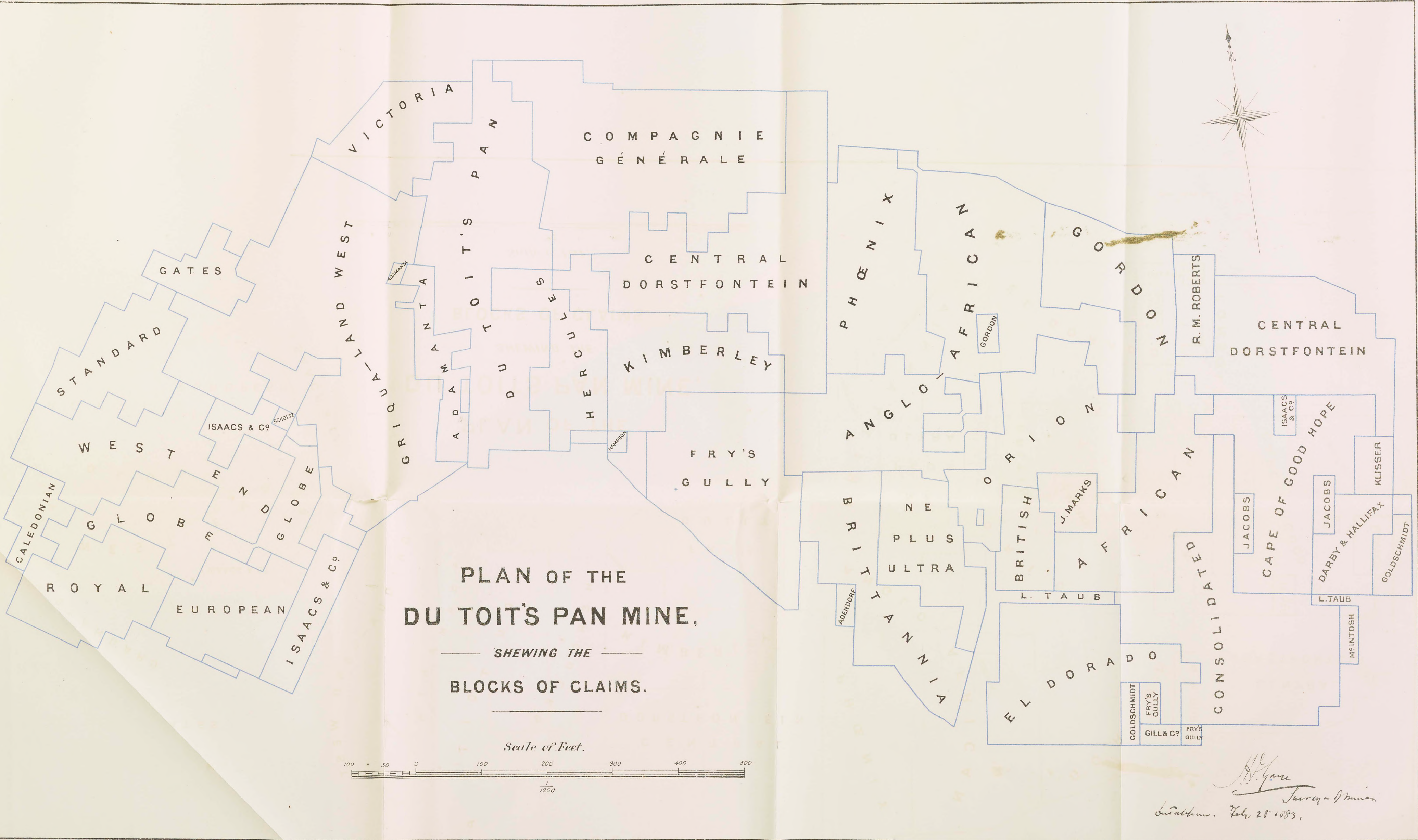
20 10 0 10 20 30 40 50 CHAINS



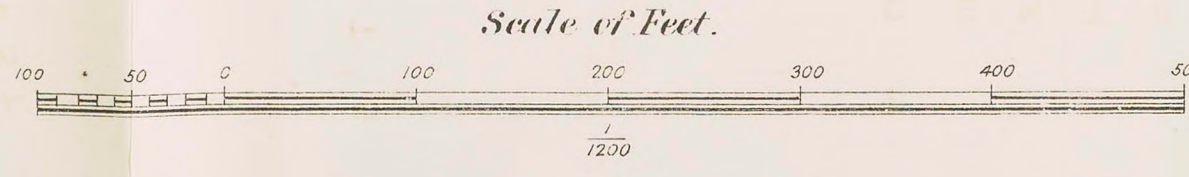








PLAN OF THE  
DU TOIT'S PAN MINE,  
— SHEWING THE —  
BLOCKS OF CLAIMS.



H. G. G.  
Surveyor of Mines.  
Batavia, Feb. 28 1883.







FO

